SERVICE MANUAL

FIMI

HIGH RESOLUTION GRAPHICS MONITOR

FC 16N / FC 20N

Technical Operations Manual

Philips High Resolution Graphics Monitors

Models C16-N and C20-N

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Preface

This Technical Operations Manual is divided into three major parts:

- Part I - Monitor Operations
- Part II - Adjustment Procedures
- Appendix

Part I, Chapters 1-6, describes the major components of the monitor, including a monitor overview and circuit descriptions for each of the major component blocks.

Part II, Chapters 7-13, provides instructions for adjusting the monitor's controls and includes a chapter on troubleshooting.

Appendix A presents a series of diagrams describing monitor dimensions, control locations, and how to access and replace monitor component boards.

Appendix B contains layout diagrams for the monitor's five component boards.

Inserted in the back of the manual is a monitor circuit diagram which is referenced throughout the document.

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Chopper Board
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Video Preamplifier Board
Socket Board

Insert: Monitor Circuit Diagram

1 Monitor Overview

The C16-N and C20-N are high resolution color monitors specifically designed for CAD/CAM applications to display graphic and alphanumeric information with a resolution of up to 1280 x 1024 pixels. The monitors are in a plastic cabinet with a tilt/swivel base.

1.1 Block Diagram

The block diagram of the monitor is shown in Figure 1-1.

The electronic circuits are divided among the following blocks:

- POWER SUPPLY and DEGAUSS CIRCUITRY
- DEFLECTION BOARD
- VIDEO PREAMPLIFIER BOARD
- CRT SOCKET BOARD
- DYNAMIC FOCUS BOARD (only for C20-N)

Each of the blocks are described in Chapters 2 through Chapter 6.

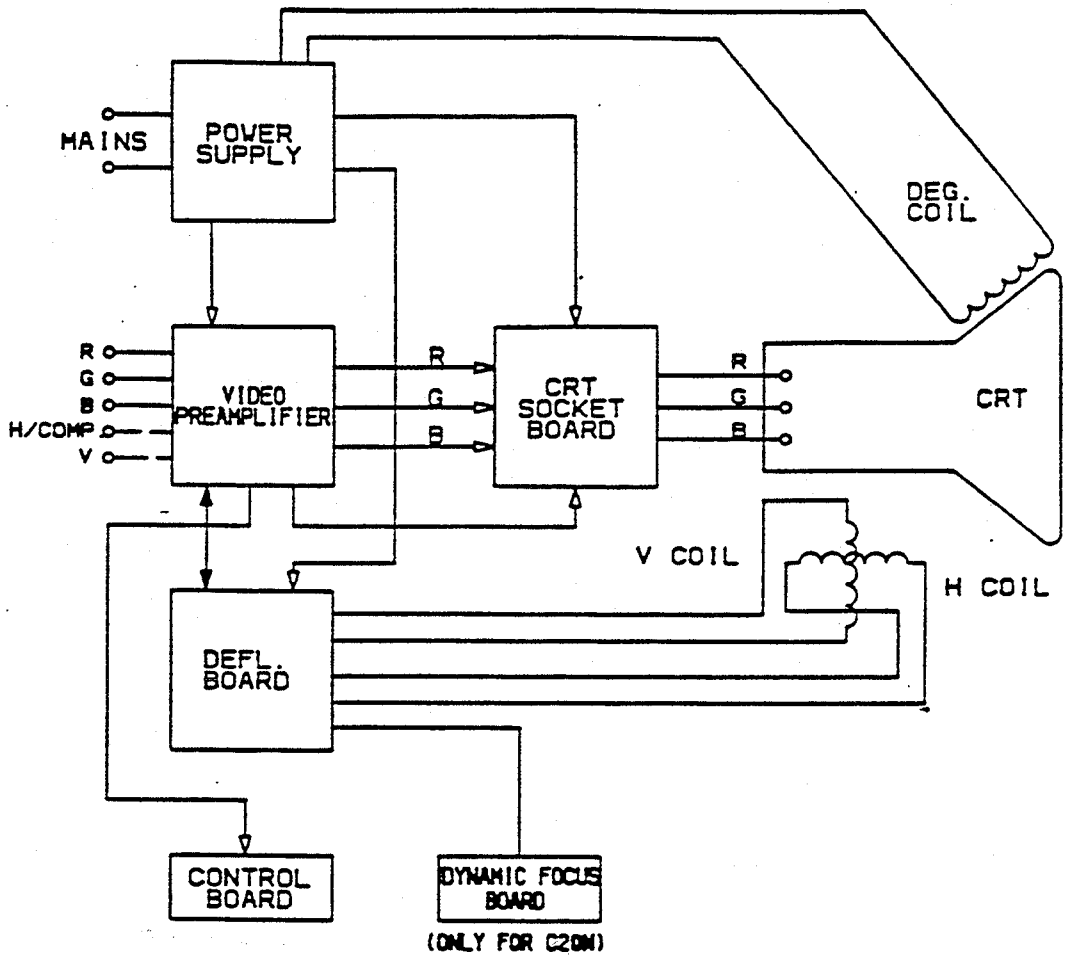


Figure 1-1. Monitor Block Diagram

1.2 Monitor Specifications

Refer to Appendix A for dimensional diagrams for the C16-N and C20-N monitors.

1.2.1 Picture Tube

M48KDB56 X 40 (20")
M38JFJ37 X 31 (16")

- 16" and 20" high resolution color tube coil assembly
- 90° deflection angle
- 0.28 (16") and 0.31 (20") trio dot pitch
- 29 mm neck diameter
- P22 phosphor, medium-short persistance
- CIE chromaticity coordinates: $X_r = 0.618$ $X_g = 0.280$ $X_b = 0.152$
  $Y_r = 0.350$ $Y_g = 0.605$ $Y_b = 0.063$

  white coordinates: $X = 0.281$ +/- 0.02
  $Y = 0.311$ +/- 0.02

  White coordinates are measured at the center of the CRT face on a white window equal to 25% of total picture.

  The contrast control is set to 30 FL.

  The brightness control is set to the threshold of raster extinction.

- Brightness
  1. Normal intensity mode: 30-35 FL at 0.7Vpp video input signal. Brightness is measured at the center of the CRT face on a white window equal to 25% of total picture with the contrast control set to maximum and brightness control set to the threshold of raster extinction.
  2. Uniformity: Maximum variation from center to edge is < or = 40% (monotonic). Brightness is measured on a full white page with brightness control set to the threshold of raster extinction and the contrast control set at 20 FL at the screen's center.

Misconvergence: 0.15 in the center
0.35mm within a circle diameter equal to the image height
0.45mm in the corners

Color purity: No color impurity for each of the R,G,B colors

1.2.2 Deflection

- Horizontal

  Frequency range: 48 to 64 kHz
  Blanking time: >3.5 usec
  Retrace time: 2.8 usec

- Vertical

  Frequency range: 50 to 120 Hz
  Blanking time: 39 lines
  Retrace time: 550 usec

- Synchronization

  Composite sync on green (0.3Vpp)
  75 ohm input impedance

- Geometry

  With nominal video inputs pincushion barrel trapezium shall fall within a 3mm band formed by two concentric rectangles.

- Linearity

  Difference between displayed character sizes:
  a. worst case - $E_y = 10\%$
  b. between adjacent characters - $E_y = 5\%$
  [E_y = (max size - min size / max size) x 100]

- Jitter, hum: not visible

1.2.3 Video

- RGB inputs: 75 ohm, analog with sync on green
- amplitudes:

  video pulse: min 0.65V - max 0.75V - typical 0.7V
  sync pulse: min 0.27V- max 0.33V - typical 0.3V

- Resolution: up to 1280 x 1024
- Bandwidth: 110 MHz (at -3dB) linear
- Rise and fall times: < or = 5 nsec
- Overshoot: max 8%

1.2.4 Power Supply

- AC input — Range A 92-132V
  Range B 184-264V
  Range select accessible by the user
- Mains frequency: 47/63 Hz
- Switching frequency: 43 Hz +/- 2 Hz
- In-rush current limitation: 50A/2 usec
- Max. consumption: 120W

1.2.5 Controls

- External:
  Brightness, Contrast, Manual Degauss, and Power On/Off
- Internal:

H-PH:	Horizontal Phase
V-Hold:	Vertical Frequency
Height:	Vertical Size
V-Cent:	Vertical Shift
S-Pin:	East/West Pincushion
V-Lin:	Vertical Linearity
Width:	Horizontal Size
H-Lin:	Horizontal Linearity
H-Cent:	Horizontal Shift
Serv:	Service Switch (collapsing Vertical Deflection)
Trap:	Trapezoidal Corrections

1.2.6 Input Connectors

- Signals: BNC (75 ohm)
- AC power: CEE 22-6A

1.2.7 Safety

- UL, CSA, DHHS, VDE, PTB, TUV approved

1.2.8 EMI/RFI

- VDE0871/6.78 class B approved
  FCC-15J class B (approved on Philips system)

1.2.9 Reliability

- MTBF: more than 25,000 hours (including CRT) as per MIL-HDBK 217D at 25°C

1.2.10 Environmental Conditions

- Operating ambient temperature: 0°C to +40°C
- Storage temperature: -40°C to +65°C
- Humidity: 5% to 90% RH (non-condensing)

2 Power Supply and Degaussing Circuitry

This chapter describes the circuitry of the Power Supply and the Degauss Coil. Figure 2-1 presents a simplified block diagram of these components.

2.1 Power Supply

The power supply works at a fixed frequency of about 43 KHz in flyback mode.

The mains voltage, rectified (R1) and filtered (F1), is applied to the power transformer (T1) which, by the switching power transistor (Q1), transfers the voltages and the energy necessary for proper operation to the secondary side.

The mains voltage range is selected by an external voltage selector slide switch. In the 110V range, the bridge rectifier acts as a doubler circuit, and in the 220V range, the bridge rectifier acts as a normal rectifier circuit.

An auxiliary voltage (Vaux) is also obtained from the primary side of the transformer which supplies the Pulse Width Modulator (PWM) circuits (based on the TDA 1060 IC), the driver stage, and the automatic-manual degaussing circuitry. During startup of the power supply, the auxiliary voltage is not present, and the voltage necessary for the PWM is derived directly from the rectified mains.

The startup time is determined by an R-C network; the power supply can only be restarted after the R-C network has been discharged.

On the secondary side of the power transformer, the square waveforms are rectified and filtered (RF2, RF3), providing the following output voltages: +64.5 V, +30V, +14.5V and +6V.

The +64.5V output is sensed and subtracted from a stabilized reference voltage. The error signal is amplified and sent to the PWM circuit via an opto-coupler, where it is compared to a triangular waveform at fixed frequency. The resulting square waveform modulates the duty cycle in proportion to the error signal in order to keep the output voltage constant at +64.5V against mains voltage and load variations.

This square waveform is then amplified by the driver stage (transistor Q2 and driver transformer T2) and is applied to the power transistor T1, thereby closing the feedback loop.

There are two protection thresholds. The primary current is sensed by resistor RS. If the first protection threshold is exceeded, the duty cycle is contained (thus limiting the output power). If the current increases even further and surpasses the second threshold, the power supply is switched off.

If the higher output voltages (+64.5V and +30V) are short-circuited, the primary current increases causing the power supply to be switched off.

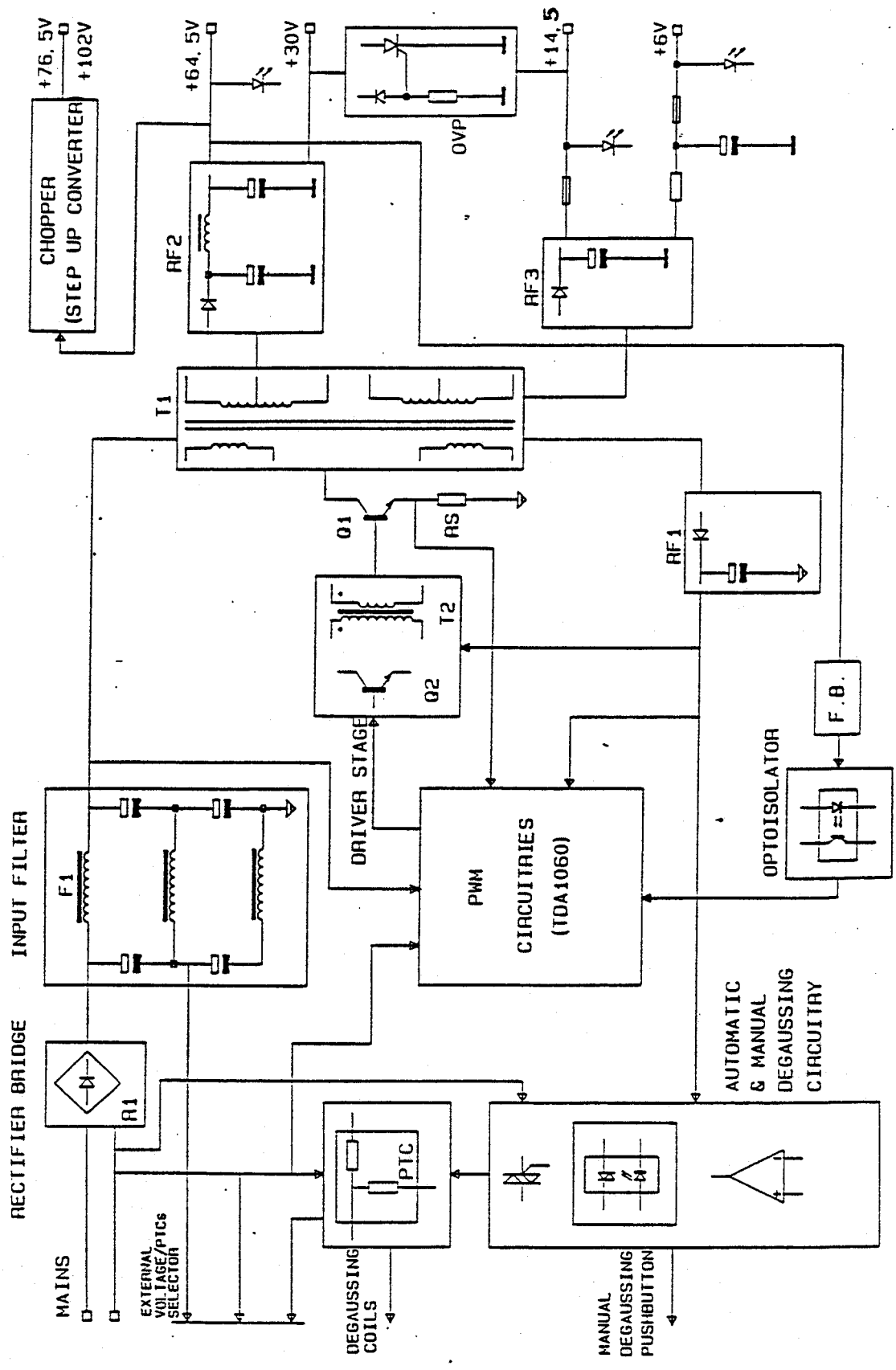


Figure 2-1. Power Supply and Degauss Circuitry Block Diagram

If the lower output voltages (+ 14.5 V and + 6V) are short-circuited, the primary current does not reach the turn-off threshold due to the lower power; for this reason, these outputs are short-circuit protected by a fuse. (An LED after the fuse indicates if the voltage is available on the output.)

In series with the + 6V output, the resistor produces negative current feedback in order to limit current variation.

An OVP circuit in the classic crowbar configuration senses the 30V and + 14.5V output voltages. The + 30V output voltage is short-circuited by an SCR whenever the sensed voltage exceeds + 17.5V.

2.2 Chopper

Figure 2-2 presents a simplified chopper block diagram, and Figure 2-3 is a circuit diagram of the chopper.

A chopper circuit is mounted on the power supply and provides an output voltage which can be adjusted by a multi-turn trimmer from 76.5V to 102V. The horizontal deflection stage needs an input voltage proportional to the line frequency. In this way, a single power supply unit can be used for the whole family of monitors from 48 to 64 KHz.

The chopper contains a boost switching regulator working at a fixed frequency of about 75KHz, a power inductor L, a power mosfet Q, a rectifier diode D, an output filter F, and a PWM. The + 64.5Vdc input voltage comes from the power supply.

When the mosfet is turned on, the input voltage is applied across the power inductor, which stores the energy.

When the mosfet is turned off, the energy stored in the inductor creates a voltage which switches on the diode and transfers the energy to the output filter and then to the load. Additional energy is also transferred from the input directly to the output during the diode conduction time.

The + 64.5V input voltage is applied to the PWM circuitry (based on IC UC3842) via the resistor R.

The output voltage is sensed and is sent to the PWM where it is subtracted from a stabilized reference voltage.

The duty cycle of the PWM square waveform is modulated in porportion to the error signal and current amplitude in order to keep the output voltage constant against input voltage and load variations.

This square waveform drives the power mosfet, thus closing the feedback loop. When a short circuit occurs at the output, the input supply voltage is overloaded and the power supply is switched off.

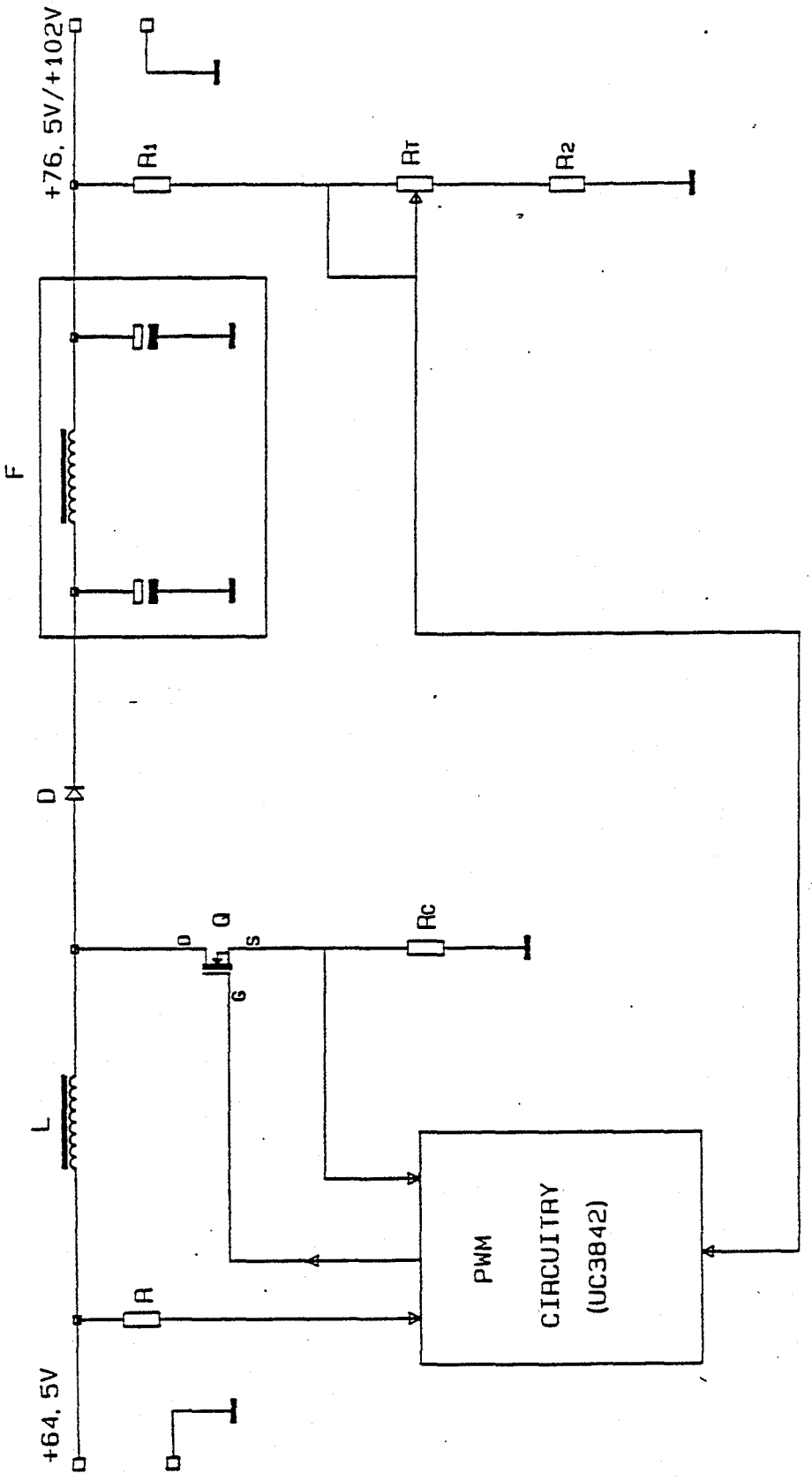


Figure 2-2. Chopper Block Diagram

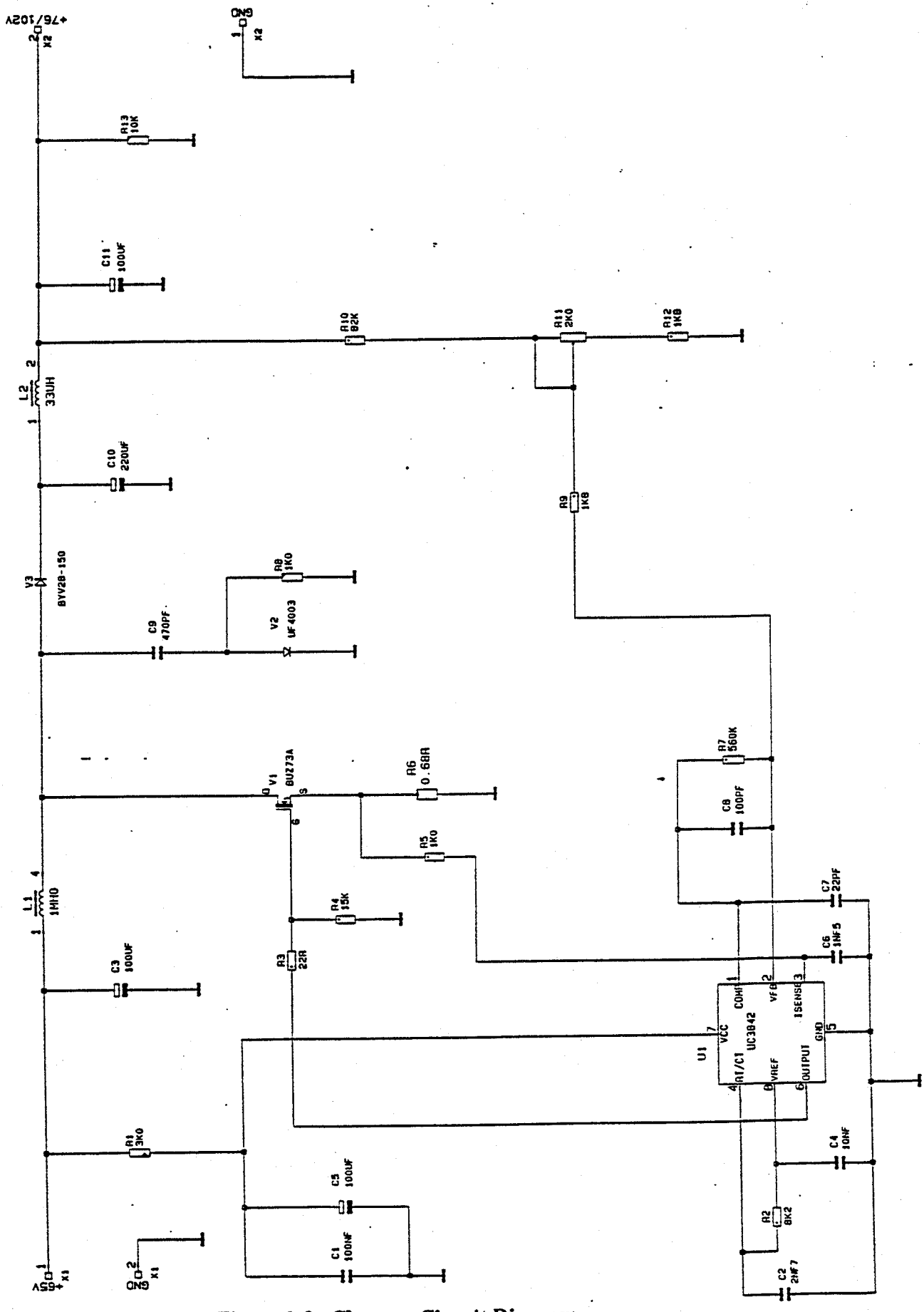


Figure 2-3. Chopper Circuit Diagram

2.3 Degaussing Circuit

The automatic and manual degaussing circuitry supplies current (via the PTC) to the degaussing coils mounted on the CRT for about ten seconds.

The current supply is limited to ten seconds in order to allow the PTC to cool off again and to remove the small residual demagnetizing current which could affect spot landing. After approximately five minutes, the external manual degaussing controls can be used again.

The degaussing circuitry consists of an R-C network, a comparator, an opto-coupled triac driver and a triac, which connects the selected PTC to the mains.

The R-C circuit determines the on-time of the triac.

Upon startup, the comparator drives the triac via the opto-coupler. When the R-C network reaches its trip point, the comparator inhibits the opto-coupler from driving the triac.

If the PTC is cold, the unit can be degaussed by simply discharging the R-C network with an external pushbutton.

3 Deflection Board

The deflection board contains the following circuits:

- Horizontal Deflection with EHT Generation
- EHT Stabilization Circuit
- Vertical Deflection

Refer to the Monitor Circuit Diagram included with this manual.

3.1 Horizontal Deflection

3.1.1 Horizontal Driver And Output Stage

The horizontal or composite synchronization signal coming from the video preamplifier board is applied to pin 11 of IC U1 (TDA 2595/V7).

The local horizontal oscillator in IC U1 is locked by the input synchronization signal. There are two phase loops.

The first phase loop compares the phase between the synchronization pulse and the oscillator. The range of this phase comparator is limited in order to prevent damage to the deflection circuitry at synchronization frequencies beyond the acceptable range.

The second phase loop compares the phase between the oscillator and the horizontal flyback pulse which is derived from pin 7 of the line output transformer and applied to pin 2 of the IC U1. This loop compensates for storage time variations in the horizontal deflection transistor V5.

Resistor R13 will pull pin 4 of U1 high when transistor V4 does not conduct. When driver transistor V4 conducts, a primary current will flow through the driver transformer T1.

The secondary winding on this transformer supplies a negative base current to the output transistor, V5. The base storage charge is first removed by this negative current, after which, the output transistor actually ceases to conduct. The slope of this negative current is determined by the leakage inductance of the driver transformer and the negative drive voltage, which is the sum of the transformer drive voltage and the voltage across the base capacitor C24. After the storage time, the base emitter voltage is driven into negative breakdown. During this time, called the zenering time, the collector and the base current decrease to zero and turn-off is complete.

As soon as pin 4 of U1 is pulled low, the base voltage of V4 will fall below the emitter voltage and V4 will be switched off. When the primary current in T1 is interrupted, the magnetizing current in the secondary winding appears as an almost constant positive base current and V5 is turned on.

R21 prevents undesired conduction of V5 caused by ringing in the driver stage. C17 is a speed-up capacitor.

The V4 collector peak voltage is limited by the damping network R18 and C18.

The supply voltage for the horizontal scan is derived from the power supply and is connected to the line output transformer T5 at pin 6.

3.1.2 Diode Modulator

The diode modulator has two functions:

- horizontal amplitude adjustment
- east/west pincushion and keystone correction

3.1.2.1 Horizontal Amplitude Adjustment

Since the average voltage across a coil has to be OV, the sum of the voltages across C29 (S-correction capacitor) and C32 (modulator filter capacitor) has to be equal to the supply voltage.

The width adjustment, pincushion and keystone correction circuits vary the voltage across C32, which in turn causes an identical and inverted variation on C29, equivalent to the scan voltage for the horizontal deflection coil.

This means that a DC variation on C24 will result in a different supply voltage for the horizontal deflection coils and therefore will affect the horizontal amplitude.

The advantage of this type of modulator is that the EHT is independent of the horizontal amplitude.

3.1.2.2 East/West Pincushion Correction

The east/west pincushion correction is needed to obtain straight left and right sides of the picture. The required shape of this correction signal is a parabola which is created by integrating the vertical sawtooth signal (as available on resistors R92-R93--see vertical deflection stage, Section 3.3).

The sawtooth voltage is applied to a circuit built around a QUAD OP-AMP (U3 - LM324) which generates the waveforms for east/west pincushion (R110) and keystone correction (R123); these waveforms are then applied via the power transistor V51 to C32 for proper horizontal correction.

This signal is sent to capacitor C32 which is the same capacitor to which the amplitude DC-voltage is applied. In this way, a parabola-shaped deflection current waveform is obtained without modulating the EHT.

3.2 EHT Stabilization Circuit

Because of the internal impedance of the EHT transformer, the size of the displayed picture varies with brightness. For good picture stability, as required in a high resolution monitor, an EHT stabilization circuit is incorporated.

A block diagram of the EHT Stabilization circuit is shown in Figure 3-1.

An error amplifier compares a fraction of the EHT voltage, derived from a voltage divider (bleeder resistor inside EHT transformer) with an adjustable reference voltage (R52) and generates a variable supply voltage for the power stage.

The power stage is a resonant flyback converter (V19, V21, C36, T4) which generates a correction voltage between 0 and 2.000 Vdc which in turn is applied to the bottom of the EHT winding.

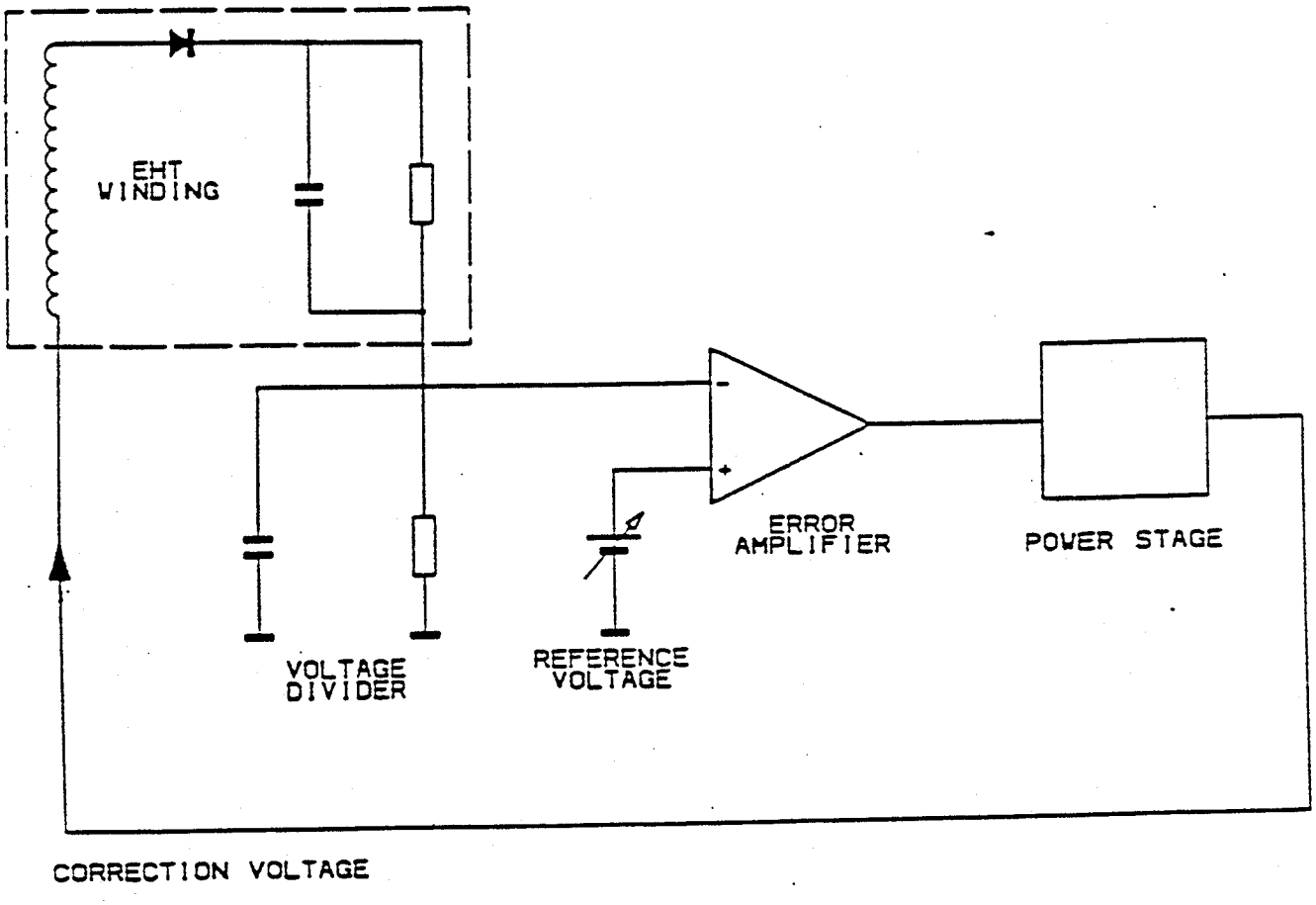


Figure 3-1. EHT Stabilization Circuit Diagram

3.3 Vertical Deflection

The key component for the vertical deflection is IC U2 (TDA 2653A).

The oscillator is synchronized on pin 2 with a positive sync pulse coming from the sync separator. The free running frequency of the oscillator can be adjusted with potentiometer R67.

The actual vertical ramp is generated by an external RC network on pin 11. Resistor R69 charges C41 and C42 from the 30V rail.

During blanking, the capacitors are fully discharged by an internal transistor.

The sawtooth ramp is internally buffered and appears on pin 3. At the beginning of scan, this signal is almost 0V.

Without negative bias current, the initial part of the sawtooth would be slightly distorted. To prevent this distortion, pin 3 is connected to a negative bias voltage via resistor R64.

During flyback, the supply voltage (pin 5) is doubled by a pulse lifter (pin 7). As soon as the inputs to the error amplifier (pin 4 and pin 10) become equal, the pulse lifter is deactivated and the scan will start.

The vertical deflection coils are driven by an AC-coupled current amplifier.

The linearity of the vertical deflection can be adjusted with R82.

The vertical amplitude can be adjusted with R89.

Vertical centering of the raster is obtained with R101, adding an adjustable DC current to the vertical deflection current.

3.4 Auxiliary Services

3.4.1 Grid 1 Circuitry and Beam Current Limiter

The function of beam current limiter (BCL) is accomplished by transistor V26. Normally, V26 is bottomed.

As soon as the EHT current exceeds the total current flowing through R55, V26 comes out of bottoming and its collector goes negative.

This voltage is sent to the remaining part of the BCL circuit located on the video preamaplifier board where it is buffered by V511.

Via diode V512, normally non-conducting, this voltage pulls Vg1 instantly to a more negative voltage when the picture is too bright.

R55 is calculated to give a maximum average beam current of 600 uA at maximum video signal.

3.4.2 Deflection guard circuit

The purpose of the deflection guard circuit is to prevent spot burn of the CRT if the monitor is switched off or if the deflection fails.

A three transistor circuit monitors both the horizontal and the vertical deflection.

A 1nF capacitor (C39) is charged during scan and discharged by the presence of proper horizontal flyback pulses. As long as the resulting sawtooth does not exceed the 6.2V of a zener diode, no action is taken.

The vertical guard is identical, except that the value of capacitor C40 is 1uF.

If either deflection ceases, the collector of V41 goes low on the next scan and will cause the grid 1 drive on the video board to become very negative. This cuts off the picture completely, overruling the actual video drive on the cathodes.

3.4.3 X-ray Protection

IC U1, R11, and associated components around the horizontal oscillator form the X-ray protection circuitry.

The flyback voltage from pin 4 of the line output transformer is rectified and filtered by V3, C15, and C16.

Part of this voltage is applied to pin 8 of U1, and when it exceeds a certain level, U1 is blocked, switching off the monitor.

The trip threshold is regulated by R11 in such a way that under no circumstances can the EHT exceed 29 KV.

4 Video Preamplifier Board

Refer to the Monitor Circuit Diagram included with this manual.

4.1 Video Preamplifiers

The three video preamplifiers are located on theVideo Preamplifer Board together with sync separator and grid 1 circuitry.

The video input signal for each amplifier coming from an external BNC connector is terminated by a 75 ohm resistor.

The nominal input amplitude is 0.7 Vpp for the red and blue. The green signal has an amplitude of 1 Vpp which includes 0.7 Vpp for the video and 0.3 Vpp for the composite sync.

The description will be given only for the red amplifier since the other two are identical.

Component numbers in brackets refer to green and blue channels.

The signal enters the differential input section of the video preamplifier U401 (U431, U461) MC 1496 on pin 4.

The second part of the MC 1496, together with the dual transistor U503 (LM394) forms a four quadrant multiplier (known as a Gilbert cell). One LM 394 is used for all the three channels.

This configuration is very suitable for obtaining the individual gain setting for both the color balance adjustment potentiometer R403 (R433, R463) and the cold contrast control (potentiometer R800, transistor V504) to achieve very good grey scale tracking.

The output amplifier consists of output transistors V404 and V405 used as a Darlington.

The output current of this stage is sent to the final stage located on the CRT socket board, explained in Chapter 5.

For optimum video performance, the video output signal (which is AC-coupled to the video amplifier) needs to be referenced to a fixed DC voltage. This is achieved by an active black level clamp circuit, transistors V403, V406, V407 and diode V408 (V433, V436, V437, V438 - V463, V466, V467, V468).

This circuit is activated during the horizontal back porch time and controls the base bias voltage of V404 (V434, V464) by charging or discharging the coupling capacitor, keeping the black level at the desired value.

The grid 1 drive is a combination of four different functions:

1. Black Level Control (also called "brightness control")

   Adjust the external potentiometer R801 to change the grid 1 voltage (nominal cut off level -37V). It can therefore compensate for changes in the ambient light levels, drift during warm-up and during life of the CRT.

2. Blanking

   A vertical pulse is superimposed on VG1 via capacitor C522. This suppresses the retrace lines.

3. Total Beam Current Limiter

   The total beam current limiter information from the deflection board is buffered by transistor V511. If the picture becomes too bright, VG1 is pulled down to a more negative level by via diode V512, which is normally non-conducting.

4. Spot Protection

   As explained previously, the deflection guard circuit generates a protection signal that pulls VG1 fully negative, thus blocking any light spot on the screen.

   This safety precaution will not only work at any deflection failure or power switch-off, but also if the protection signal line itself becomes accidentally open-circuited or grounded.

4.2 Synchronization

The aim of this circuit is to subtract the horizontal and vertical synchronization pulses from the composite green video signal.

The video signal is fed via a buffer stage V505 to the sync separator V506/V50 where the composite sync is separated from the video. The composite sync is then fed to the sync processor IC on the deflection board.

5 Video Output Stages (Socket Board)

Refer to the Monitor Circuit Diagram included with this manual.

5.1 Final Video Stage

The final stage of the video amplifier is composed of transistor V602 (V612, V622) which is connected in common-base configuration. It converts the current signal coming from the preamplifier into voltage signals sufficient to drive the cathodes of the CRT.

5.2 Black Level Adjustment and Individual Beam Limiting

Because of spreads in cut-off levels among the three cathodes in any color CRT, the black level on each cathode must be adjustable over a range of about 20V to account for this differential cut-off spread.

For this purpose, a DC level shift is provided for each channel, allowing for cut-off adjustments and individual beam current limiting functions. The circuit is built around V606 (V616, V626) and associated components. This circuit keeps the coupling capacitor C603 (C613, C623) biased with an adjustable DC voltage, thereby creating a DC shift in the video output signal without affecting the dynamic range of the final stage.

This circuit also acts as an individual beam current limiter: R608 (R618, R628) carries a constant current Ibeam, which is the sum of the beam current and the emitter current of V606 (V616, V626).

If the beam current should exceed Ilim, diode V607 (V617, V627) will open and the extra current will charge C603 (C613, C623), causing the video signal to be shifted above the cut-off point and the beam current to be reduced.

5.3 Flashover Protection

The video amplifier is protected against flashover from the CRT electrodes by a neon lamp V609 (V619, V629) which acts as a spark gap between cathode and ground.

A limiting network composed of resistor R609 (R619, R629) and diode V601 (V611, V621) prevents extra currents and voltages from reaching the video amplifier.

Flashover protections from other CRT electrodes (G1, G2 and heater) are obtained by spark gaps in the form of cuts in the PCB.

G1 is further protected by V632, and G3 has a built-in discharger in the socket.

The passive components on the electrodes (R631, R633, C636, C637, C638, L631, L632, L633) are used for decoupling and filtering purposes.

6 Dynamic Focus Board (C20-N)

Figure 6-1 shows the Dynamic Focus Board circuitry. (This board is only used on the 20" monitor.)

The C20-N series of monitors employs a new CRT with a special gun called DAF (Dynamic Astigmatic Focus).

This new gun has two focusing electrodes; a dynamic correction voltage is applied to one of the electrodes.

The dynamic correction voltage is the sum of line and field frequency parabolas which are synchronized to the horizontal and vertical flyback pulses.

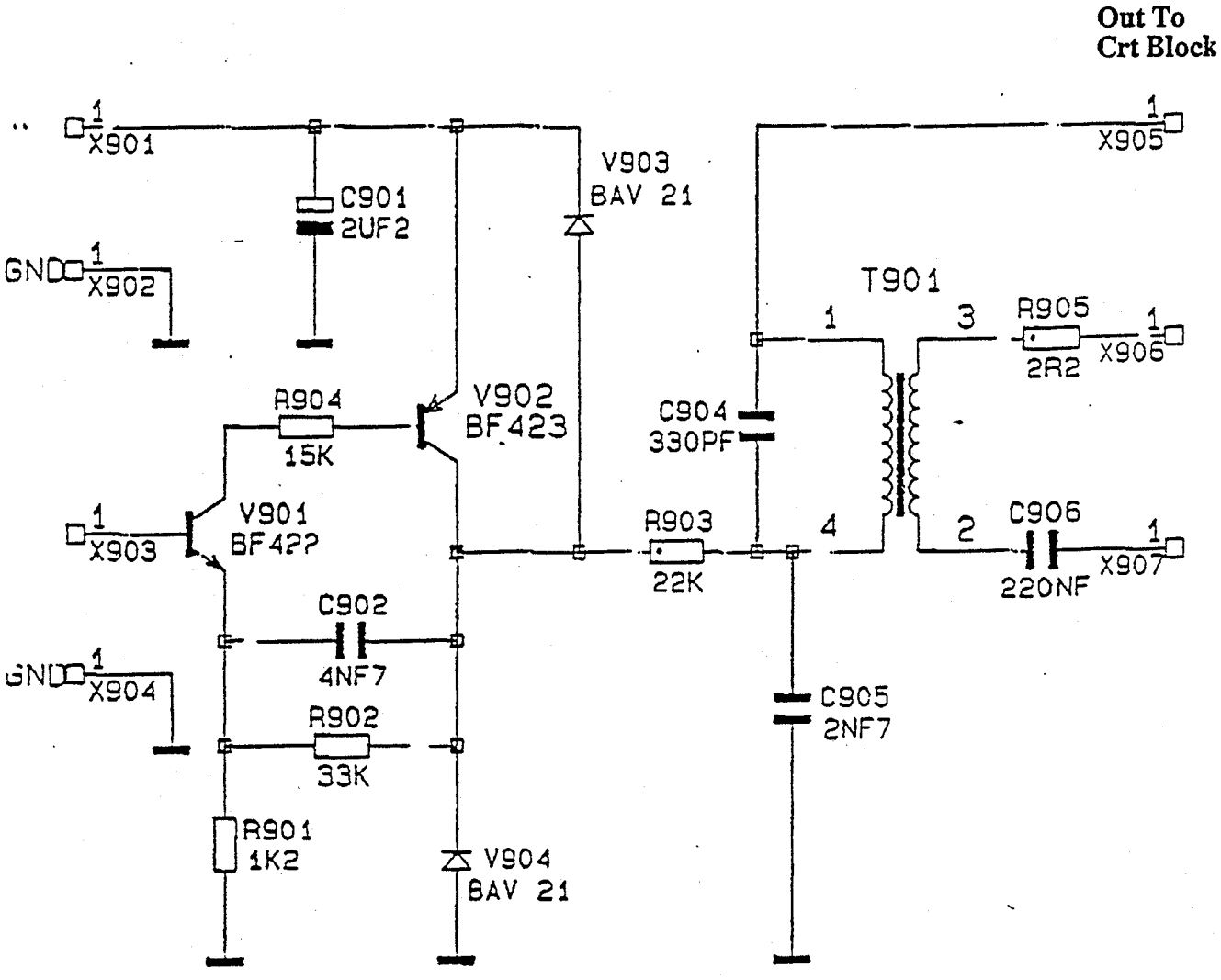
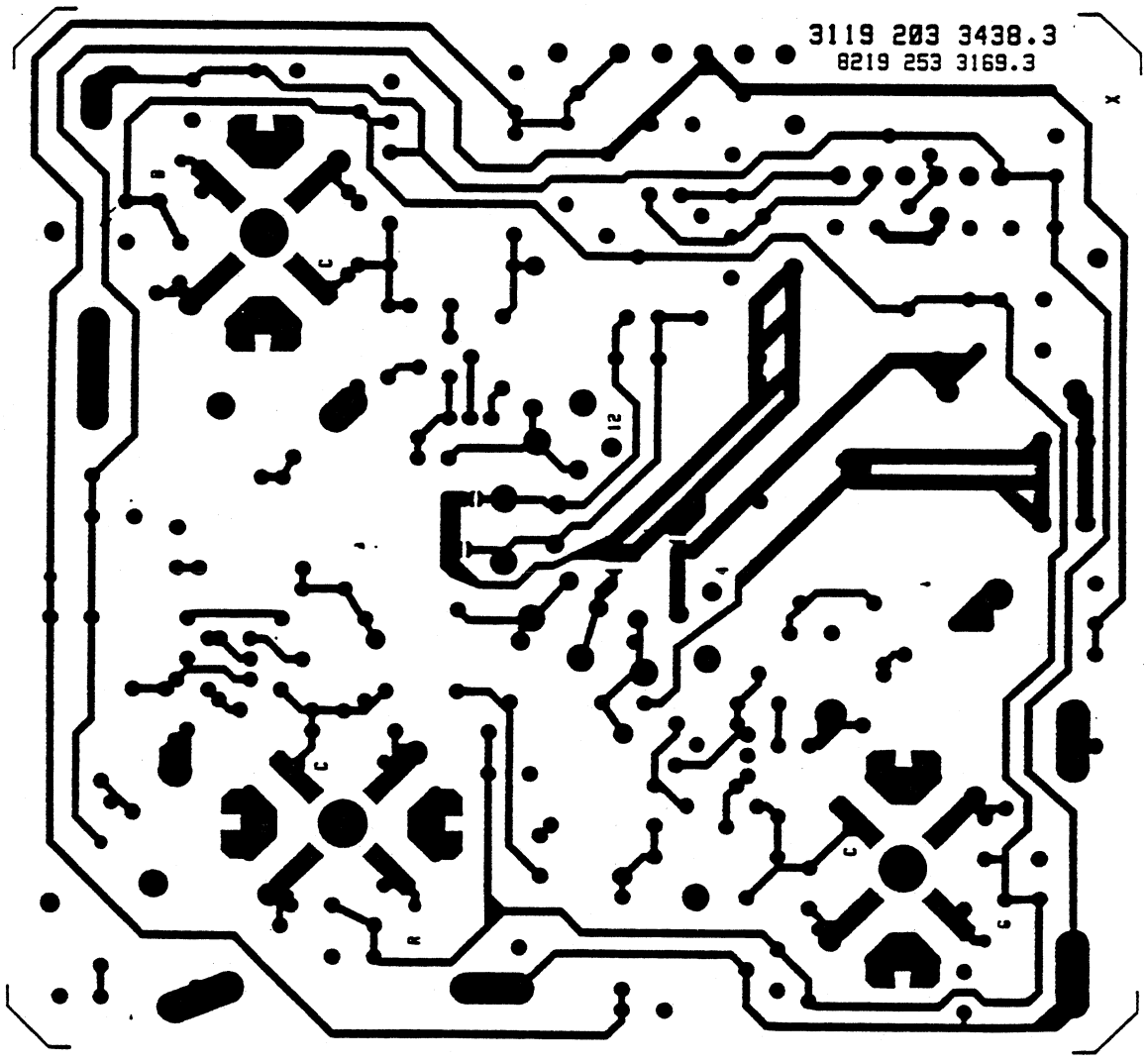
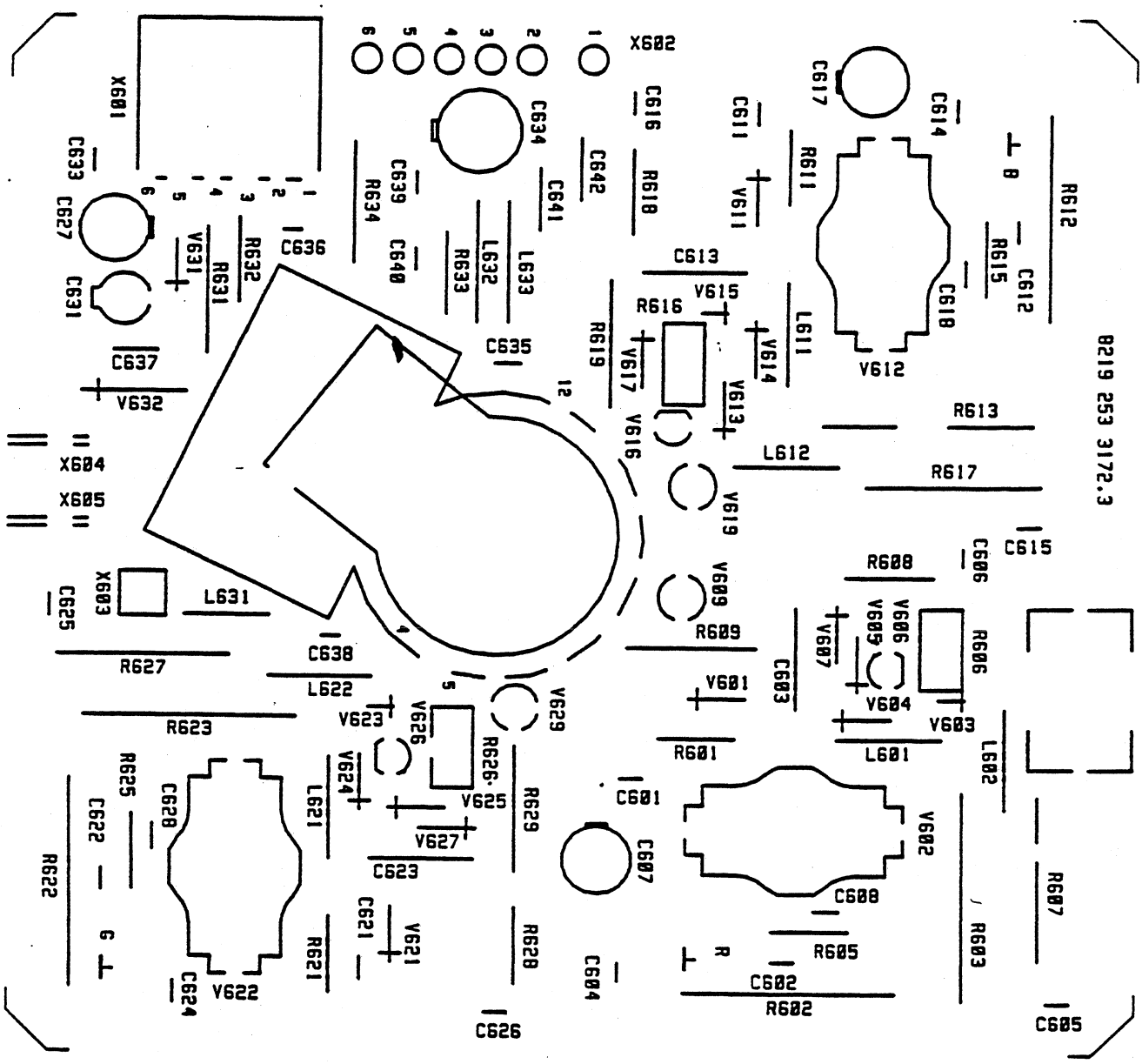


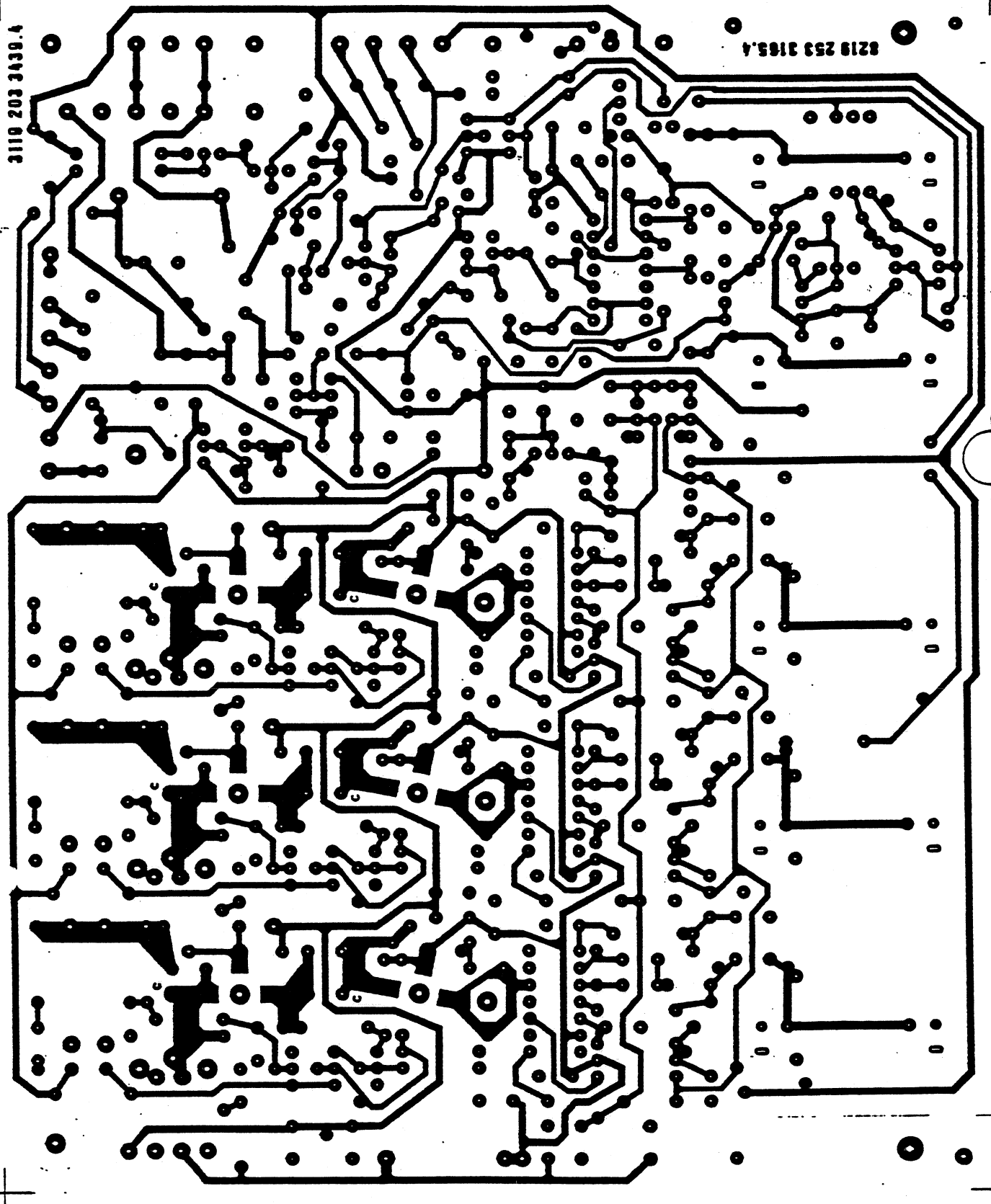
Figure 6-1. Dynamic Focus Board Circuit Diagram



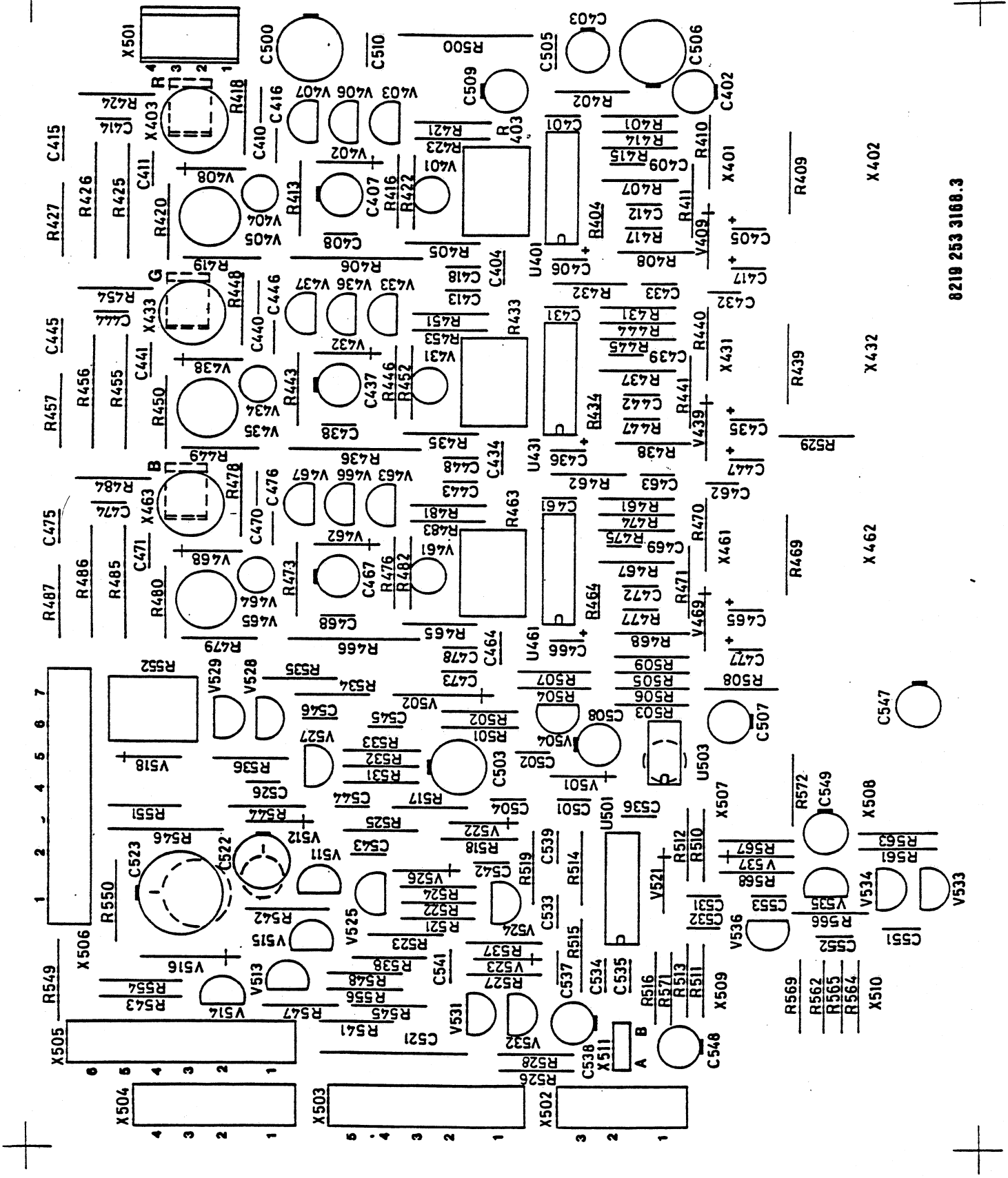
Socket Board



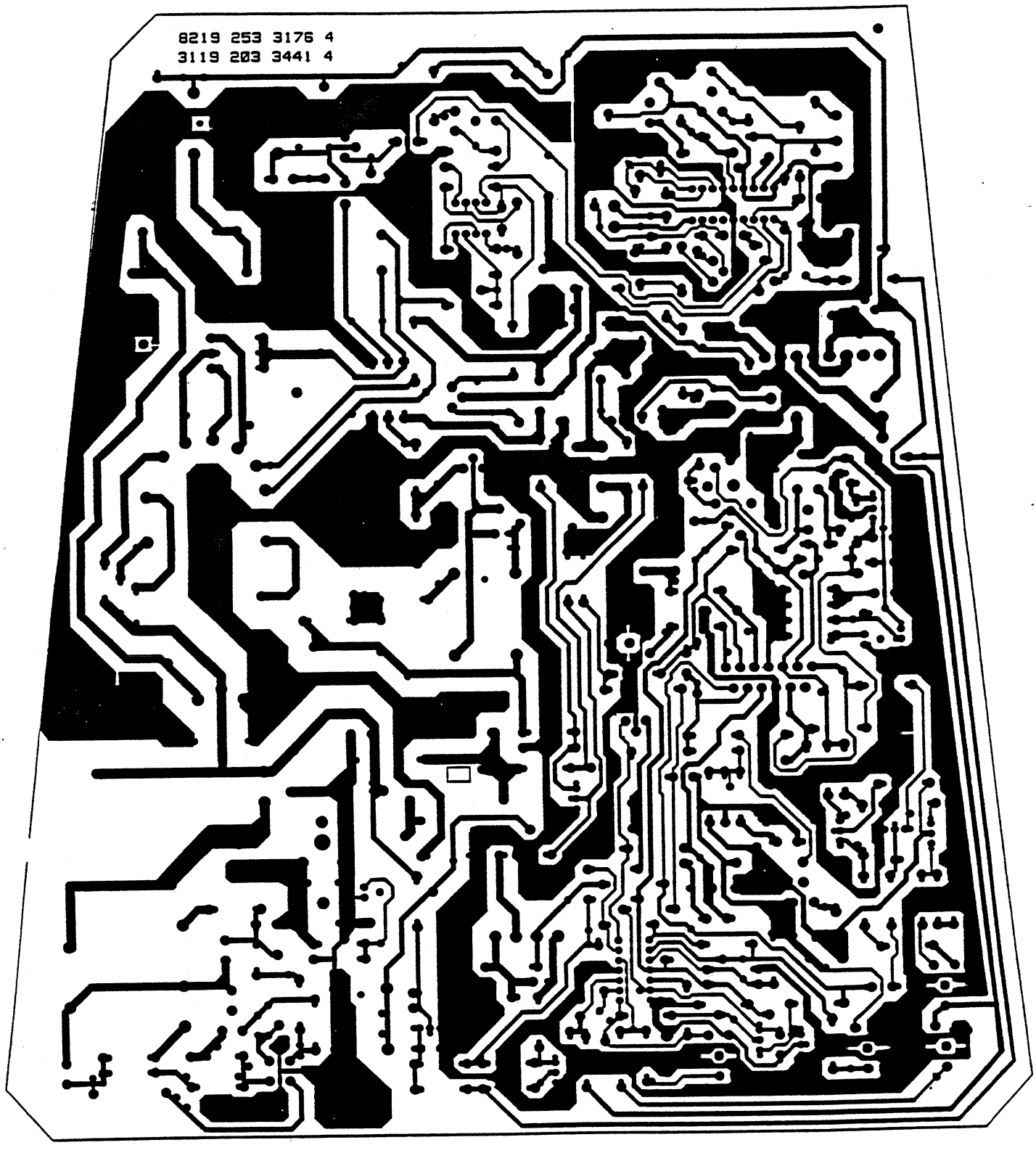
Socket Board



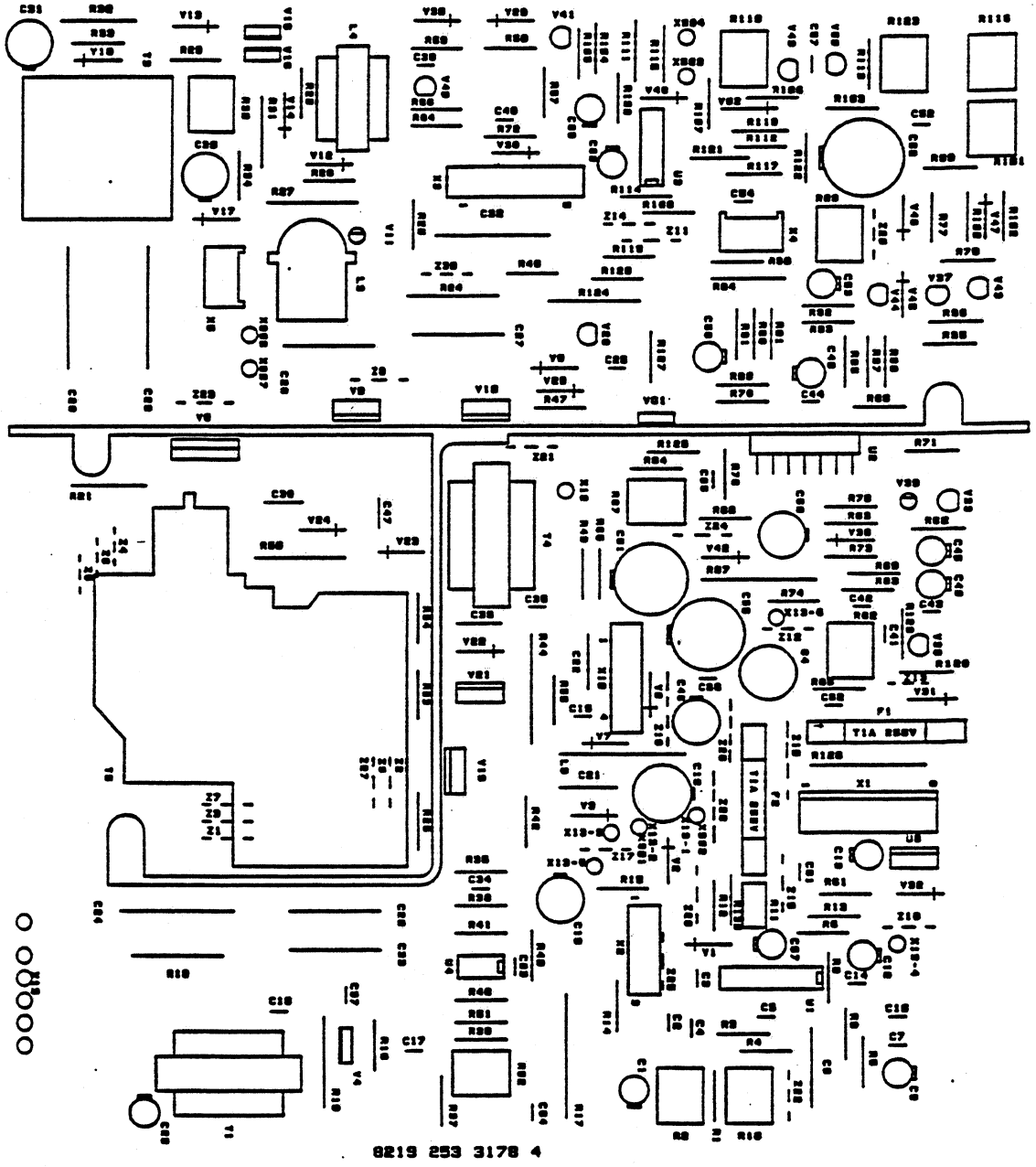
Video Preamplifier Board



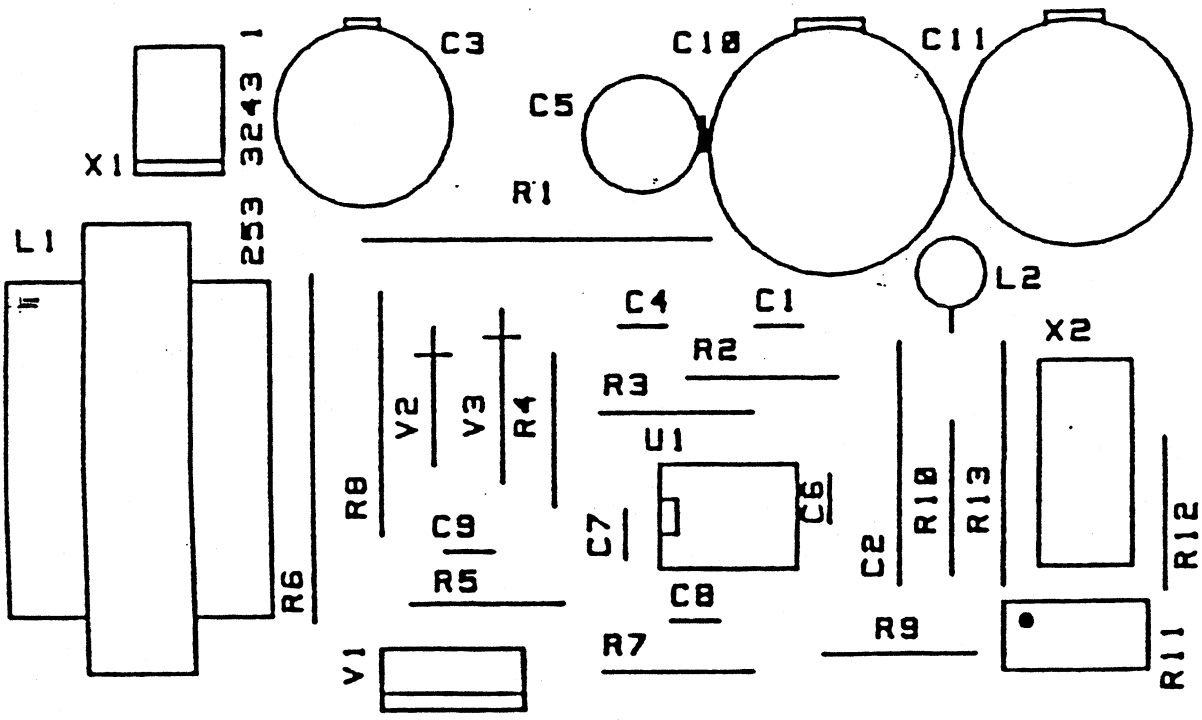
Video Preamplifier Board

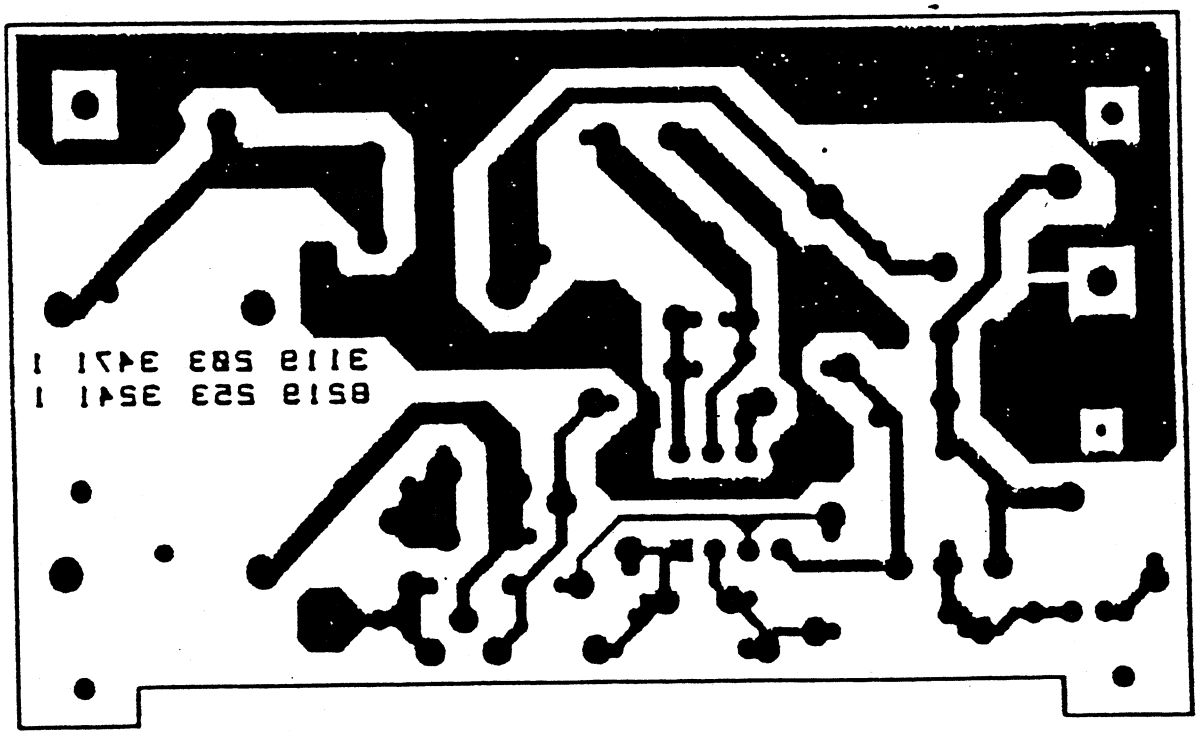


Deflection Board

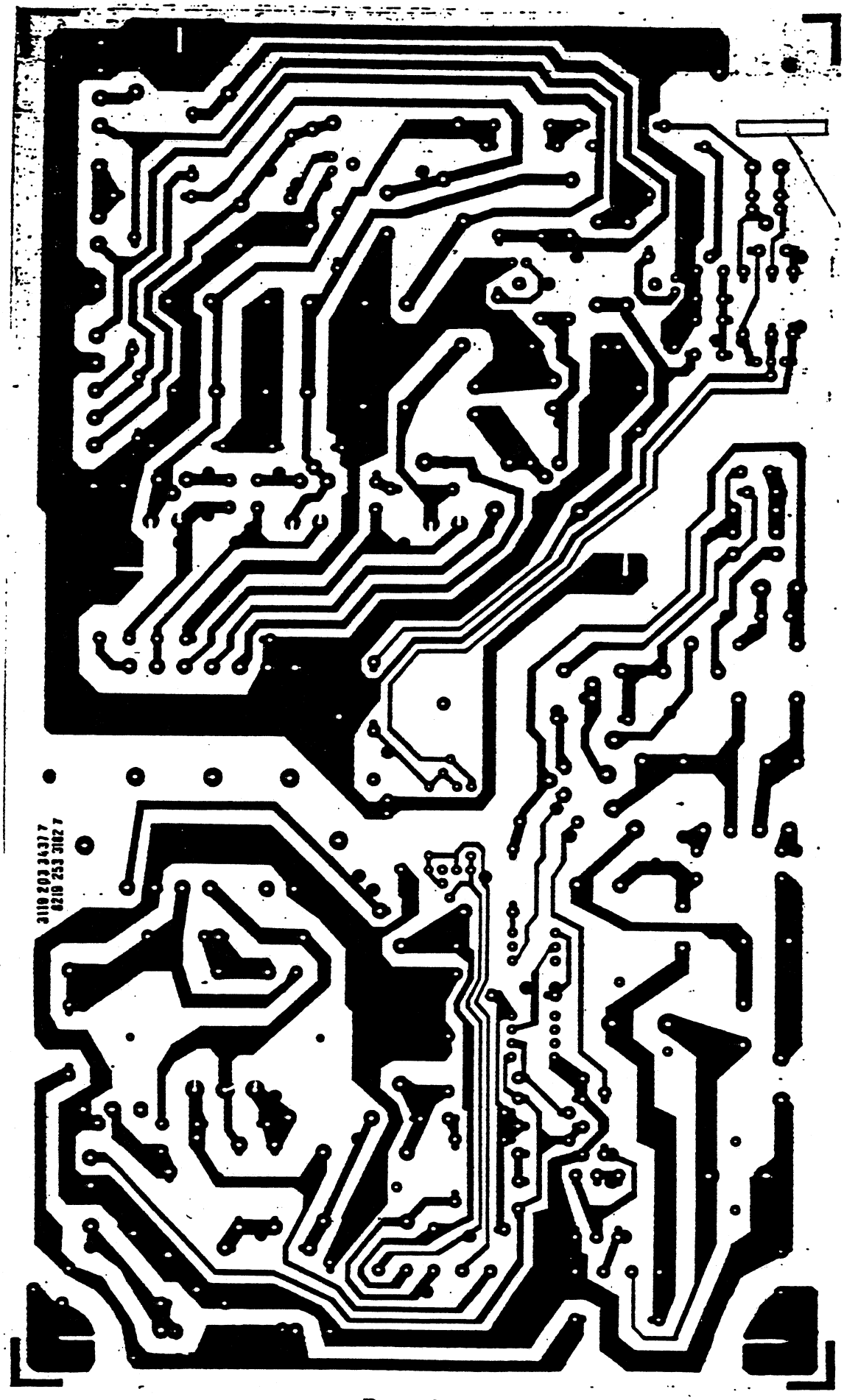


Deflection Board

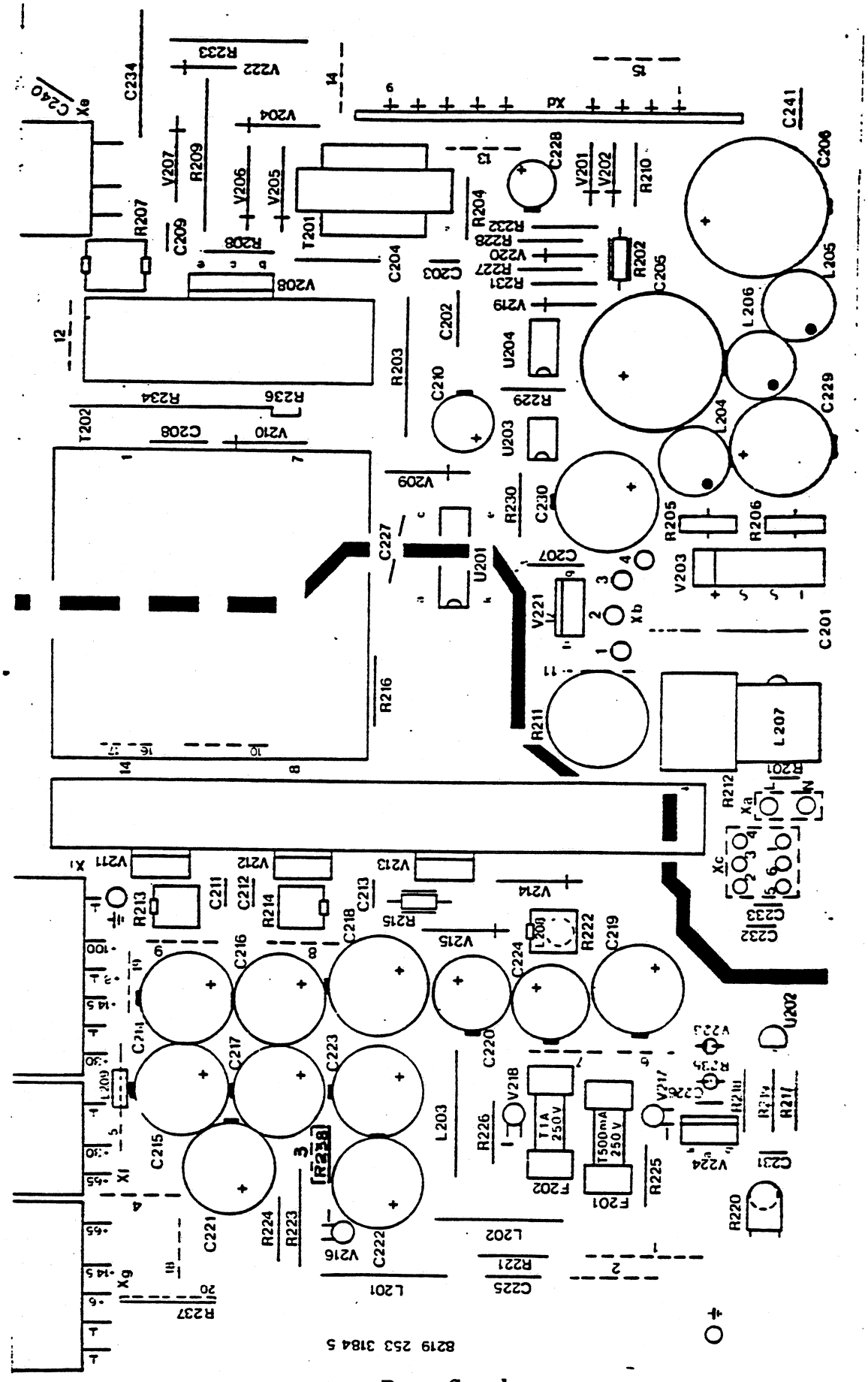




Chopper Board



Power Supply



Power Supply

7 Equipment Needed For Adjustments

The following equipment is necessary to perform the adjustments described in Chapters 8-12.

- Programmable pattern generator (Quantum 801C, Opix, Astro, etc.) or a test pattern program from the host computer
- Luminance meter
- Metric rule
- Screwdrivers of different sizes
- Degaussing tool

If you are using a programmable pattern generator, be sure you know the exact timing specification to which the monitor must be adjusted, and then set up the generator. (Follow the generator operating instructions.)

If you are using the host computer as a generator, you need a test pattern program.

The minimum set of patterns is as follows:

- crosshatch
- white page
- black page
- red, green, blue, and white central rectangles

Refer to the diagrams in Appendix A for instructions on accessing the monitor's controls.

To access service controls, remove the plastic rear enclosure. (See the control location shown in Figure A-3.)

To access cut-off, focus, screen, and dynamic focus (for C20-N) controls, you must also remove the top metal cover. (See Figure A-4.)

Note

Before you start making any adjustments, the monitor must be warmed up for at least 20 minutes. This ensures that all three electron guns are at a stable temperature which is especially critical when you perform chromaticity adjustments.

8 Synchronization

Follow the procedures below to synchronize the monitor. There are two controls that need to be adjusted:

- Horizontal Frequency - H-FREQ
- Vertical Hold - V-HOLD

H - FREQ

1. Display any pattern on the screen.
2. Short-circuit the two pins at X11 on the deflection board with the tip of a screwdriver. (You can access X11 by removing the top metal cover.) The picture will be rotating in a left or right direction.
3. Adjust H-FREQ until the picture no longer rotates. (When shorting X11, be sure not to short any other component.)
4. Remove the short and check for picture stability.

V-HOLD

1. Turn V-HOLD in either direction until the picture goes out of lock (starts rolling up or down).
2. Turn V-HOLD slowly in the opposite direction until the picture is locked.
3. Give a further quarter of a turn to V-HOLD to ensure a good locking margin.

Note

Due to component tolerances, turning V-HOLD in either direction may not cause the picture to unlock. In this case, leave V-HOLD in the middle position.

9 EHT Stabilization

C16-N and C20-N monitors are provided with an EHT stabilization circuit for good picture stability. As the adjustment of this circuit affects picture size, it must be performed before geometry adjustment.

Two adjustment procedures are described below. The first procedure is more precise but needs an oscilloscope. The second procedure is simple but still produces good results.

Procedure 1

1. Display any pattern on the screen.
2. Reduce contrast, brightness and, if necessary, screen voltage until the screen is completely dark.
3. Connect the probe of the oscilloscope to the collector (tab) of V21 (BU806) on the deflection board.
4. Adjust the EHT stabilization resistor (R52) to read a peak to peak voltage of about 30V on V21.
5. Remove the probe.
6. Put the monitor in normal brightness conditions (raster just visible).
7. Display an all white pattern and check that the picture size does not change when going from minimum to maximum contrast and brightness.

Procedure 2

1. Turn the EHT stabilization resistor (R52) fully counterclockwise.
2. Display a crosshatch.
3. Put brightness at minimum to completely blank the background raster. (If necessary, reduce the screen voltage.)
4. Reduce the contrast until you can just barely see the white lines.
5. Turn the EHT stabilization resistor until the picture size is reduced by about 3 mm (1.5mm per side) on the 20" monitor, or 2 mm (1mm per side) on the 16" monitor.

6. Set the monitor to normal brightness.

7. Display an all white pattern and check that the picture size does not change when going from minimum to maximum contrast and brightness.

10 Geometry

This chapter describes the complete setting-up procedure, starting from an unadjusted monitor. If you have to perform only small readjustments, find the appropriate starting point in the procedure below.

Controls involved in the geometry adjustments are:

- width
- height
- e/w pincushion
- trapezium/keystone
- Horizontal phase (H. phase)
- Horizontal center (H. center)
- Horizontal linearity (H. linearity)
- Vertical center (V. center)
- Vertical linearity (V. linearity)

Start putting all of these controls in the central position except for H. linearity, which should be positioned for minimum correction (maximum picture width).

Now display a centering or a crosshatch pattern and adjust the controls following this sequence:

1. Adjust H. phase to center the picture in the raster.

2. Adjust H. center and V. center so that the picture is centered in the bezel opening.

3. Adjust H. and V. linearity. If you are using a crosshatch, check that the boxes have the same width and height all over the screen. If you are using a centering pattern, check that the left and right halves have the same width, and check that the top and bottom halves have the same height.

   Linearity adjustment affects picture centering, so now repeat step 2.

4. Adjust width and height to the required values. This will not affect the previous adjustments.

5. Adjust e/w pincushion until the left and right sides of the picture are perfectly straight.

6. Adjust trapezium/keystone until the left and right sides of the picture are parallel.

7. If necessary, readjust the picture width.

11 Chromaticity

In a color CRT, white light is obtained by the addition of certain amounts of red, green, and blue light.

Chromaticity adjustment is necessary to align the emission of the three guns of a color CRT to the desired level. The adjustment is performed in two steps:

1. Cut-off Adjustment

The purpose of this operation is to align the three guns to the same threshold of emission, so they start to emit electrons simultaneously.

A. Display a black page on the screen (i.e., only sync - no video). If you cannot display a black page, turn the brightness to minimum and internal controls for minimum light output (R,G,B cut-off CCW, R, G, B gain CW, C-lim CCW). Switch off the monitor.

B. Turn the service switch on the deflection board to to its central position. (This will collapse the vertical deflection without activating spot burn protection, so a horizontal line can be displayed.) Turn the screen voltage control to the minimum setting on the monitor (fully CCW), and let it warm up for five minutes.

C. Increase the screen voltage slowly until you see a line across the screen. Remember what color it is. Reduce the screen voltage until the line disappears.

D. Repeat the above operation for the remaining two colors using the corresponding cut-off control, instead of screen voltage control.

E. Now increase the brightness slightly with the external control until you just see a white line across the screen. If the line is not white, repeat steps C and D more carefully.

F. Switch off the monitor, turn the service switch to either the left or right position, switch on again, and check for presence of the raster using the brightness control.

2. Color Balance Adjustment

The purpose of this adjustment is to get the correct white color temperature on the screen.

To perform this adjustment, you need a luminance meter and a reference monitor (i.e., a monitor which you are sure is perfectly adjusted) for calibration.

The calibration procedure is as follows:

A. Switch on the reference monitor and let it warm up for at least 20 minutes. Set the contrast control to maximum and the brightness control to the threshold of extinction of background raster.

B. Display red, green, and blue central rectangles; read and take note of the luminance for each of these patterns.

C. Now you have the reference values you can use these to adjust any monitor. Keep these values together with your luminance meter; it is recommended that you check the calibration of the luminance meter every two or three weeks.

D. On the monitor, put R-gain, G-gain, and B-gain to the minimum setting (CW), contrast control to maximum, and brightness control to the threshold of extinction of background raster.

E. Display a green central box and put green gain to maximum; measure the brightness and adjust it to the reference value for green using the C-lim control.

F. Display a red central box and adjust the brightness to the reference value with R-gain. Repeat for blue.

G. Display a white box and check that there is no color alteration (i.e., reddish or bluish, etc.), turning the contrast control from minimum to maximum. If necessary, repeat the procedure.

12 Focus

To adjust the focus on your monitor, follow the appropriate procedure below.

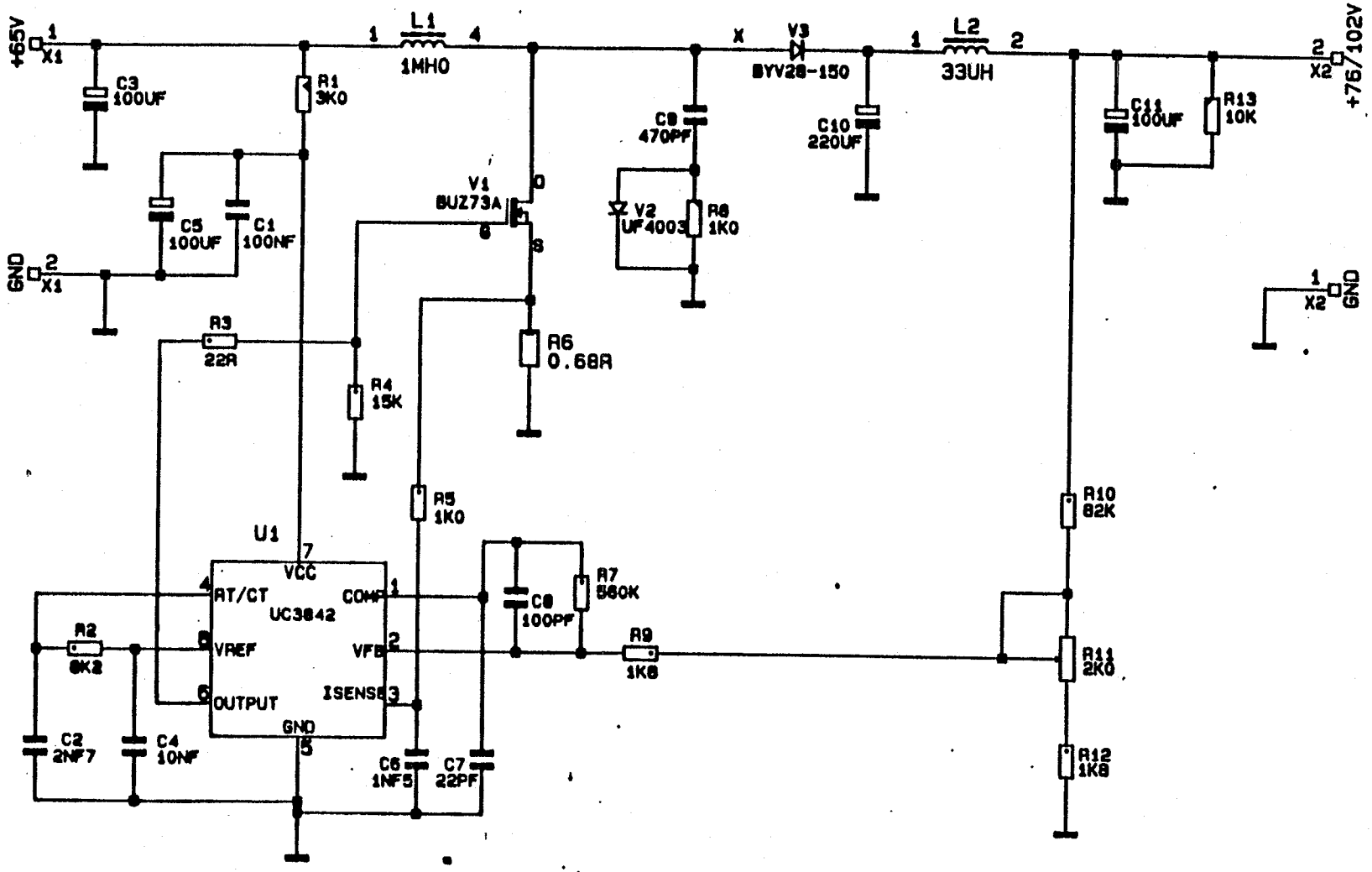
Non DAF Models (C16-N)

1. Display a crosshatch or a screenful of characters.
2. Adjust focus for maximum picture sharpness.

DAF Models (C20-N)

To adjust the focus correctly, follow these steps:

1. Display a green crosshatch and adjust focus 2 for maximum sharpness of the vertical lines. (It will also affect the horizontal lines, but that does not matter.)
2. Adjust focus 1 for maximum sharpness of the horizontal lines. (It will not affect the vertical lines.)



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13 Troubleshooting

13.1 Overview

When you encounter a problem but can still see a picture on the screen, the problem usually involves control readjustment. If there was a serious monitor failure, a protection circuit would blank the screen.

Before changing any FRU, check to see if it is possible to solve the problem by readjusting the related controls.

13.2 Indicators

The monitor has built-in indicators which can help you to understand the problem. When you do not see a picture, look at these indicators in the following order. Once you have determined that the indicator in question is working properly, go on to the next indicator.

1. Noise

If the monitor emits a crackling noise whether it is off or on, this means that either the EHT has been applied to the anode of the CRT at power on, or that the EHT is going down at power off. If you hear the noise at power on but not at power off, it means that the X-ray protection on the deflection board has been activated because the EHT has reached a dangerous level. The problem could be a failure in the SMPS (output voltage too high) or in the deflection (e.g., monitor not synchronized and working at too low a frequency).

2. Front Panel LED

If on, it means that mains voltage is reaching the SMPS. It does not necessarily mean that the SMPS is working properly.

If off, it means that mains voltage is not present. Possible causes and suggested actions are:

Cause	Action
mains absent at AC outlet	It is not a monitor problem.
bad power cord	Replace power cord.
fuse blown	Replace the fuse. If it blows again, replace the smps FRU.

3. **SMPS High Voltage Output LED**

If on, it means that the regulated output voltage of the SMPS is present. It does not necessarily mean that the SMPS is correctly adjusted.

If off, either of the following is possible:

a. The SMPS protection has been activated because of a short circuit on the output. In this case, disconnect the supply connectors from the other boards one at a time and switch the monitor on again. If the SMPS starts working, the FRU which has been disconnected is bad.

b. The SMPS is bad.

4. **SMPS Low Voltage LEDs**

The 6V and 14.5V outputs of the SMPS have a series fuse. If one of the low voltage LEDs is off but the high voltage one is on, it means that the SMPS is working correctly, but one fuse is blown because of an overload or a short on the corresponding output. In this case, before changing the SMPS, you have to find the bad FRU. The 6V line is only supplied to the socket board, while the 14.5 V is sent to the deflection and socket boards.

5. **Vertical Deflection LED**

If on, it means that the vertical deflection is working. It does not necessarily mean that it is correctly adjusted.

If off, the vertical deflection is not working, the EHT is absent, the spot burn protection is activated, and the screen is blanked. In this case, check the cabling (especially the horizontal yoke connection); if all is correct, replace the deflection board.

6. **Heater**

If the heater is on, a reddish light is emitted from the neck of the CRT when looking through the holes in the top metal cover.

If you do not see the heater, but the 6V LED on the SMPS is on, check the cabling and the socket board mounting on the neck of the CRT. If everything is correct, there is a failed component on the CRT socket board, or the CRT itself is bad.

If all the indicators are on, but you do not see any picture, there is probably a failure in the spot burn protection circuit. In this case, the CRT is always blanked. (This is the self-protection feature of the circuit.) Replace the video preamplifier board.

Appendix A

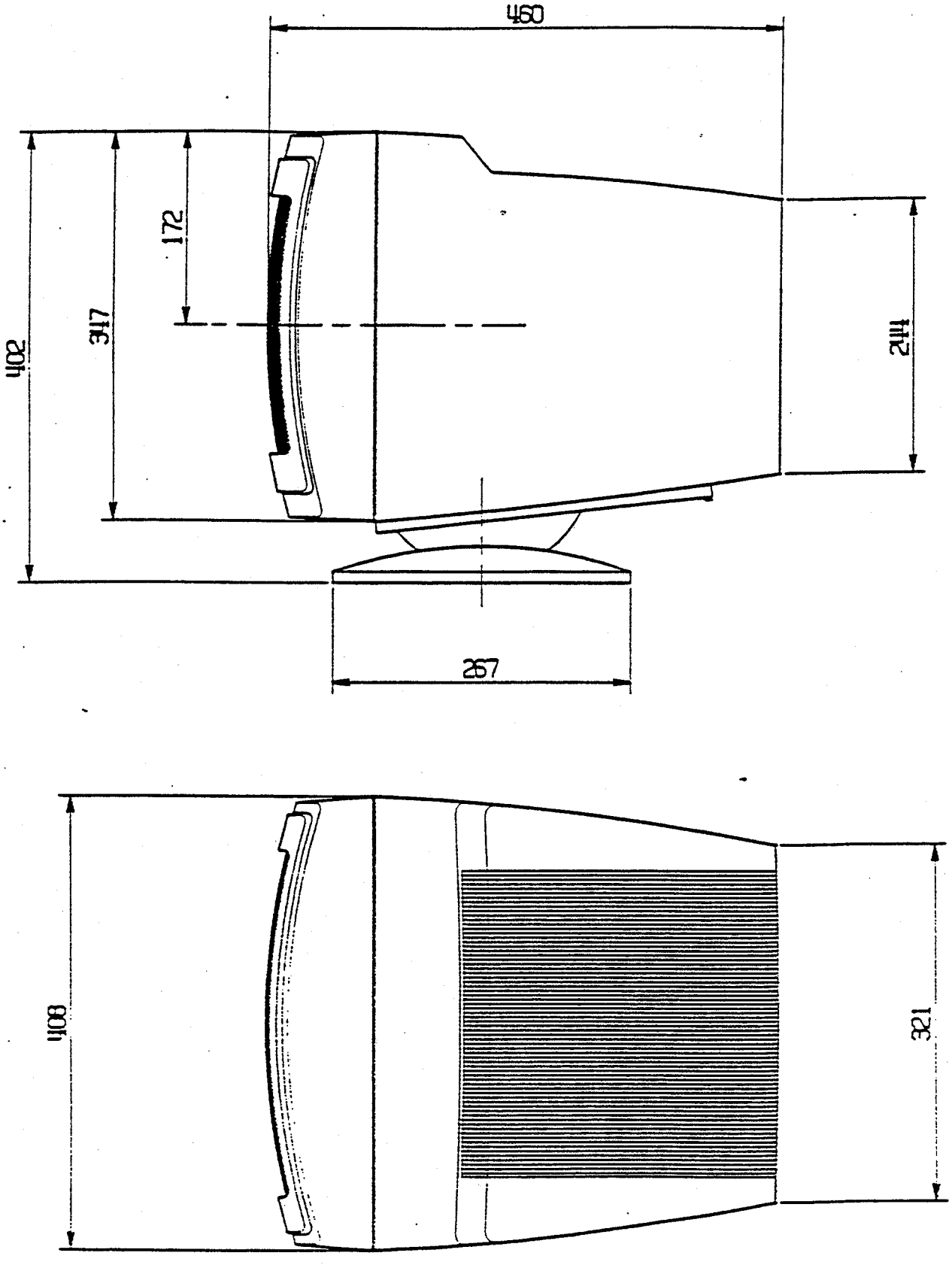


Figure A-1. Monitor Mechanical Dimensions C16-N

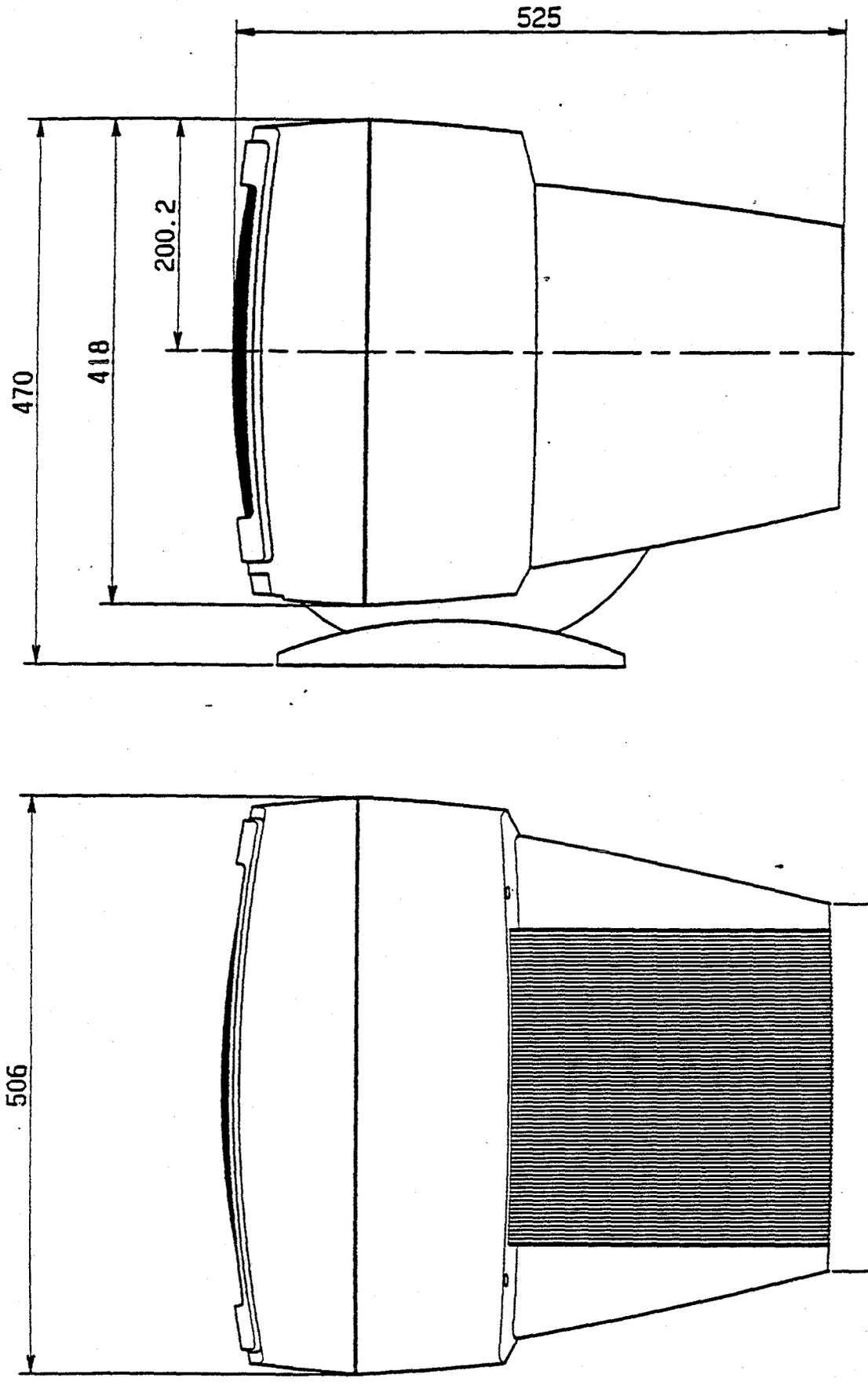
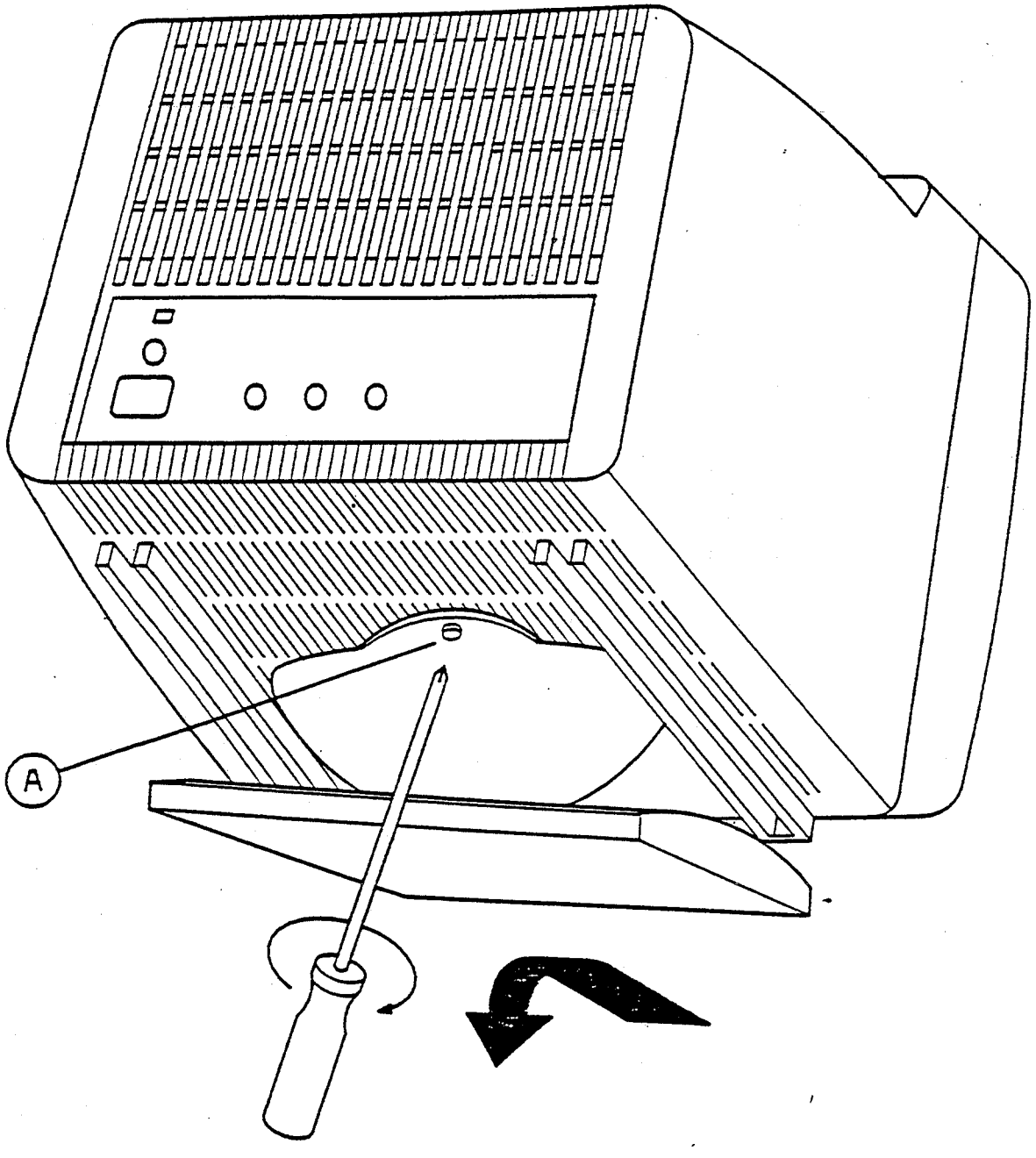


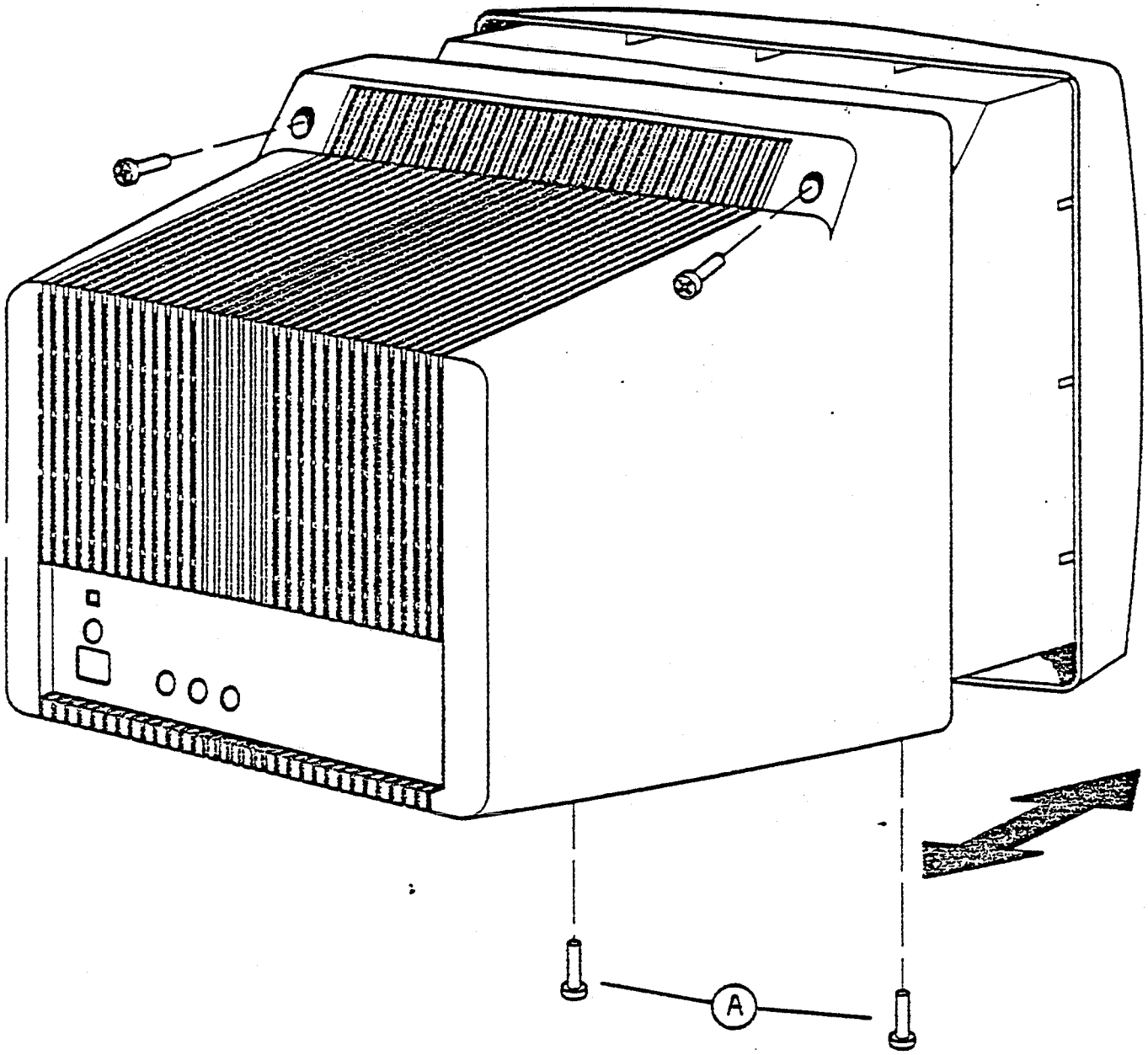
Figure A-2. Monitor Mechanical Dimensions C20-N



REMOVING OF THE PEDESTAL

1-Unscrew item (A)
2-Push backwards the pedestal
3-Remove the pedestal from the cabinet.

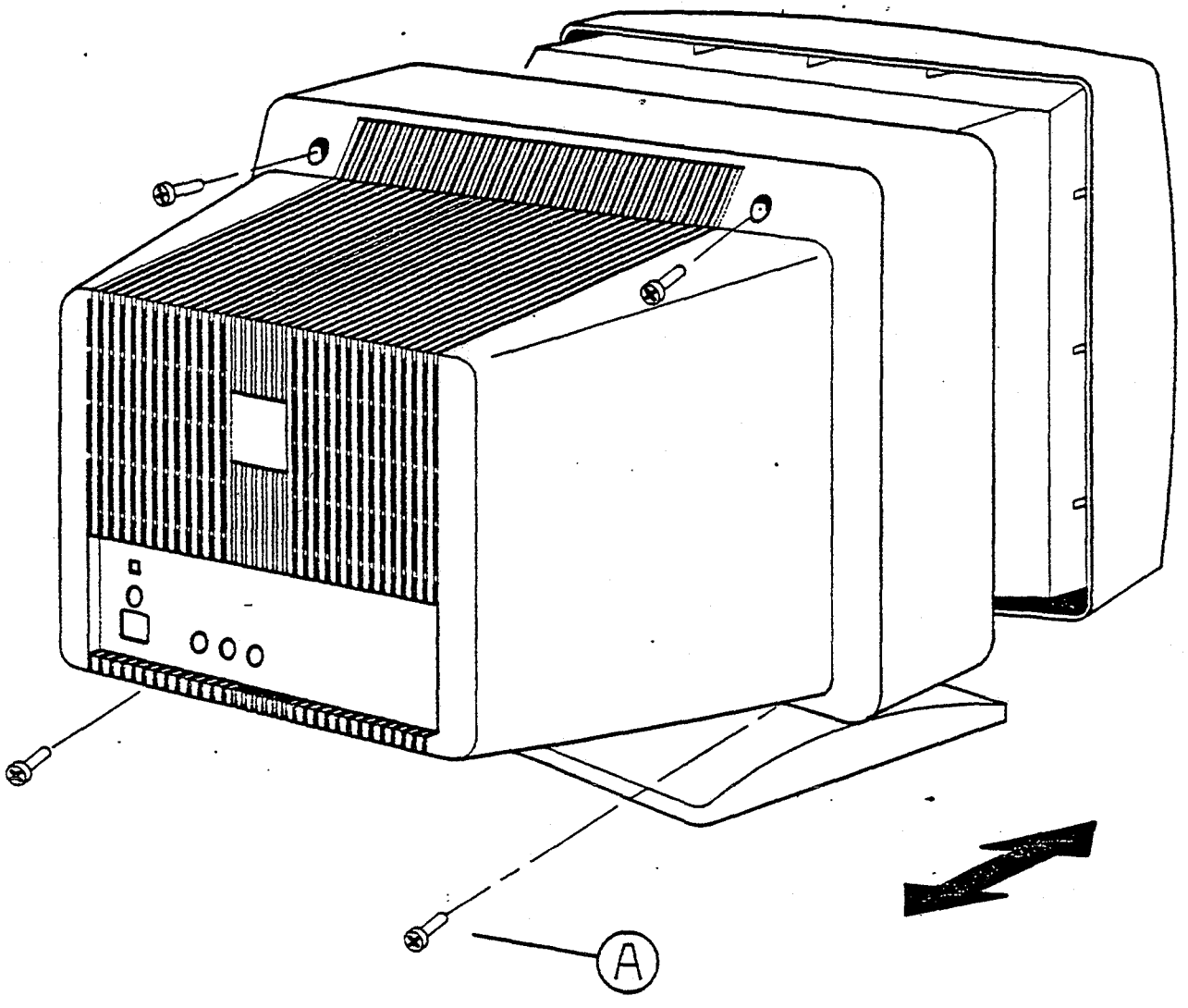
Figure A-3. Removing the Pedestal - C16-N



REMOVING THE BACKCOVER

1-Screw off the 4 item (A)
2-Pull back the backcover.
3-Remove the backcover.

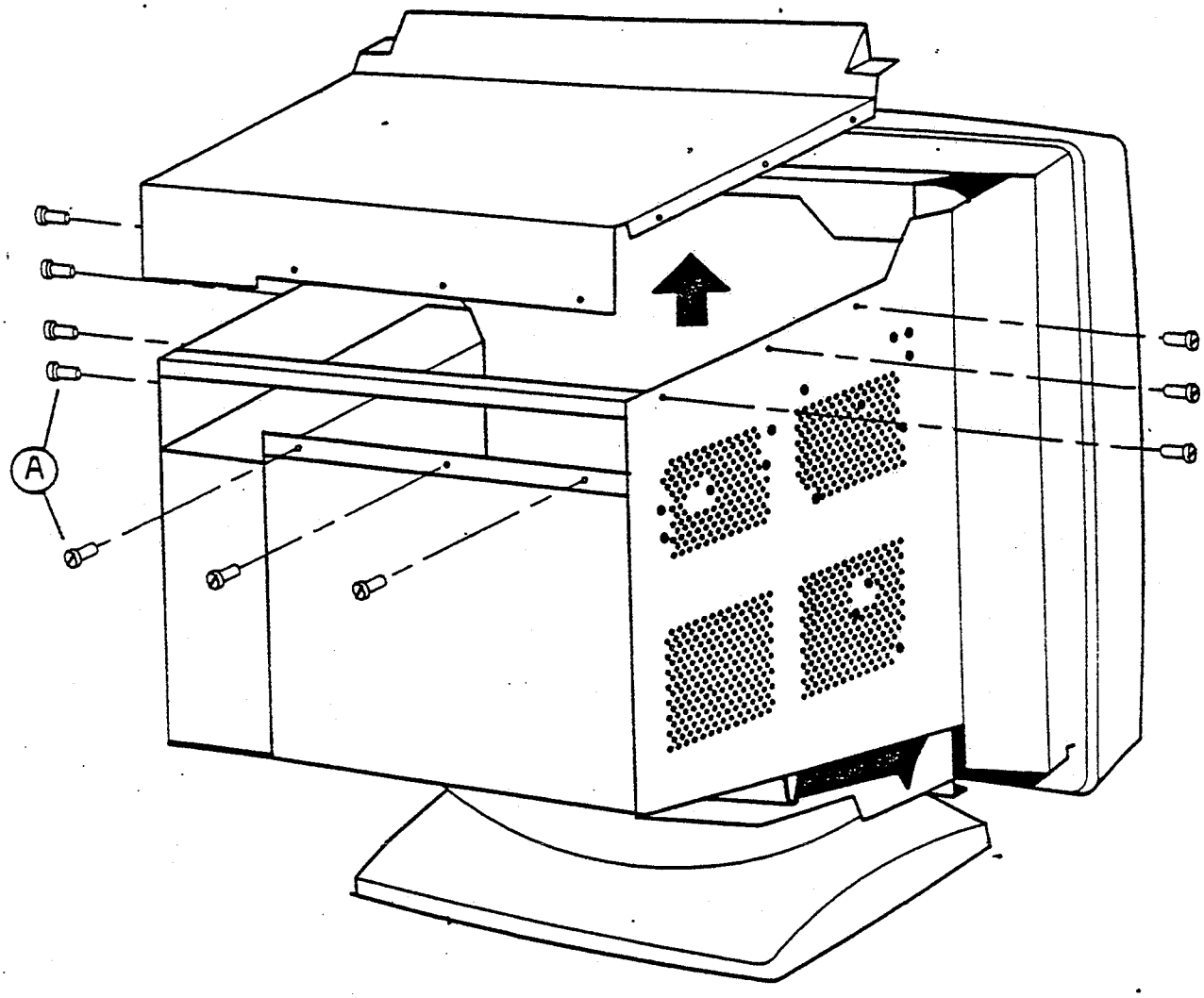
Figure A-4. Removing the Back Cover - C16-N



REMOVING THE BACK COVER

1-Remove the 4 screws (A)
2-Pull the back cover straight back

Figure A-5. Removing the Back Cover - C20-N



1-Remove the screws A
2-Lift the top side of the chassis and remove it.

Figure A-6. Removing the Top Metal Cover C16-N & C20-N

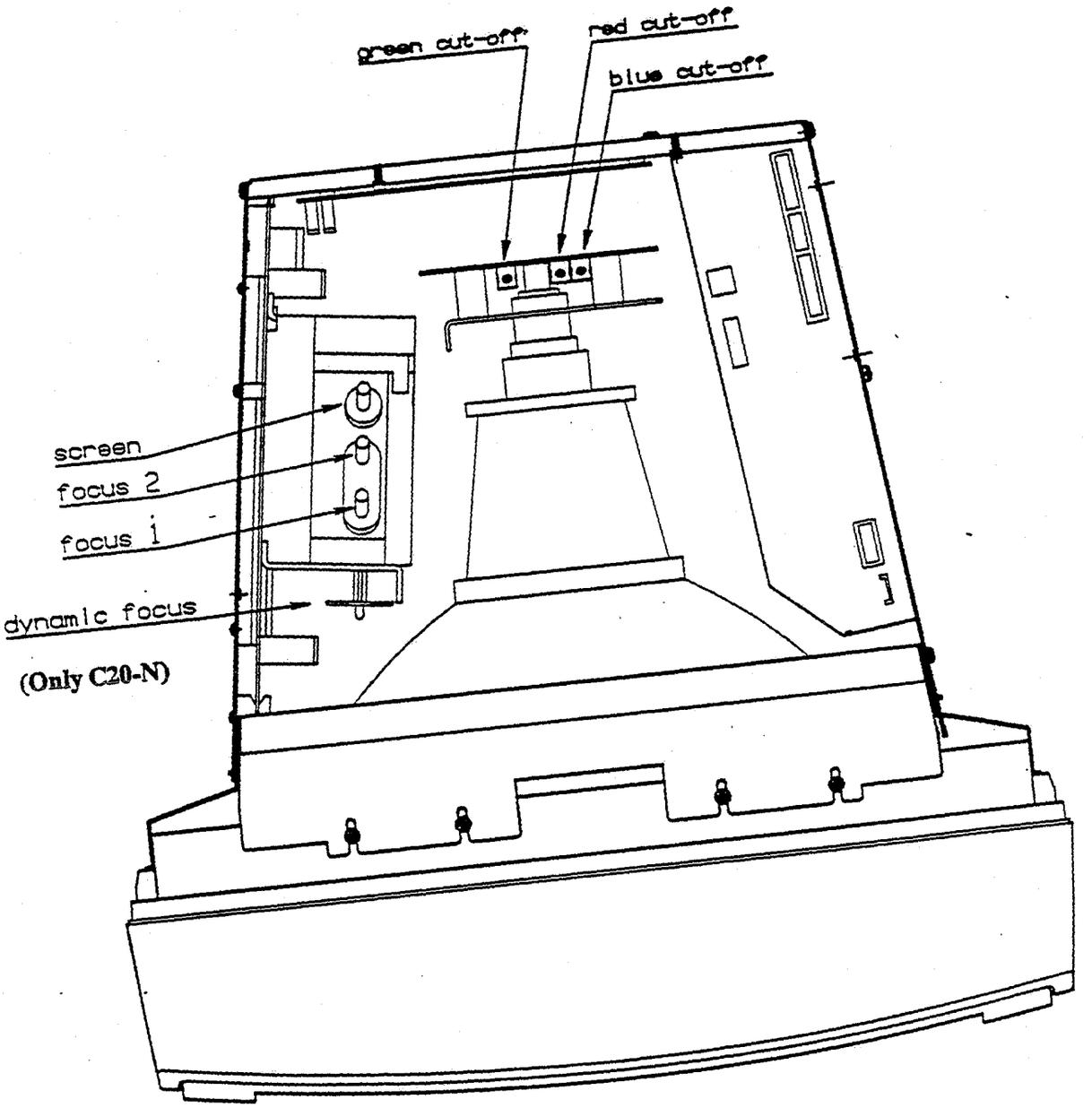
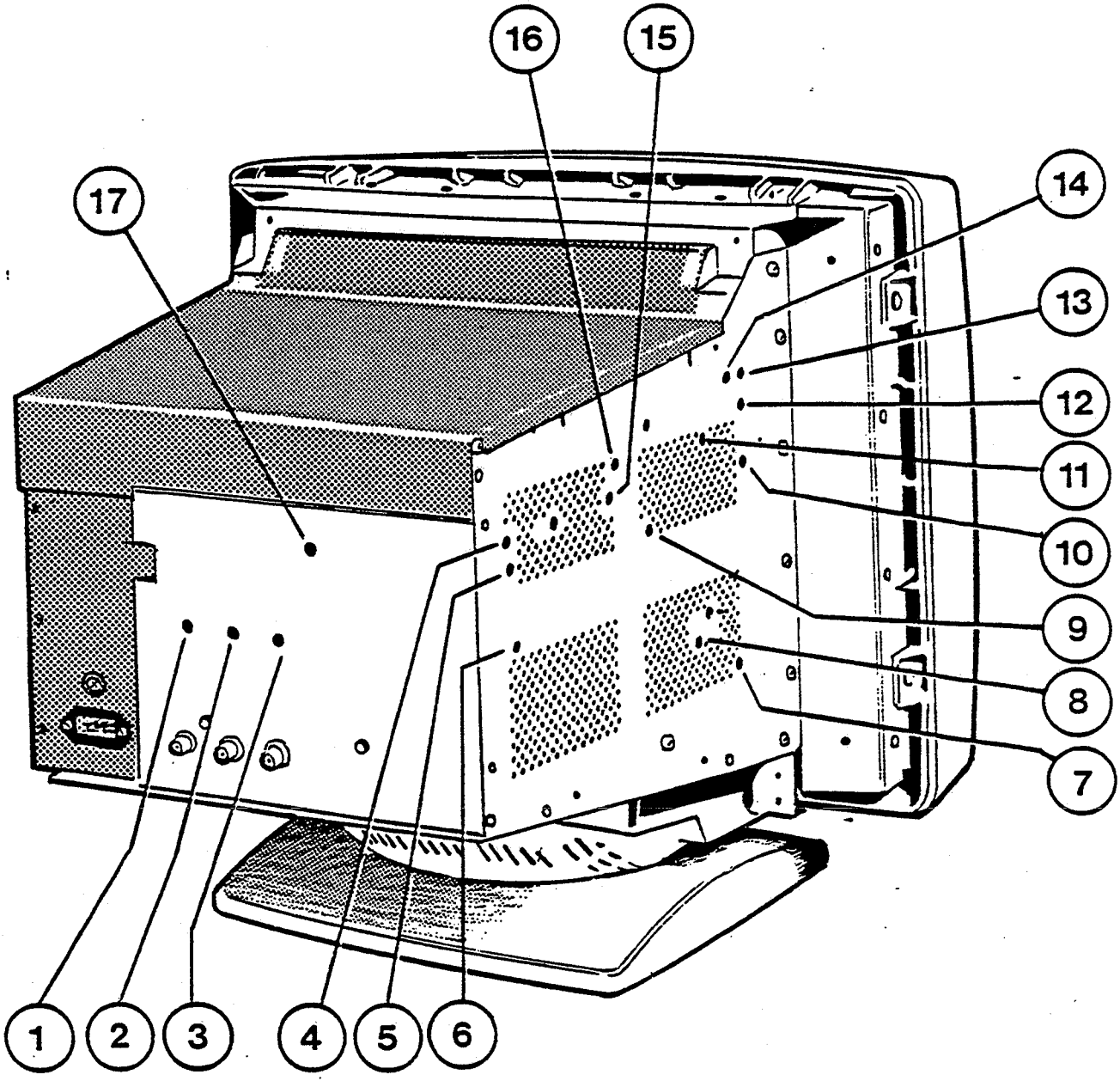
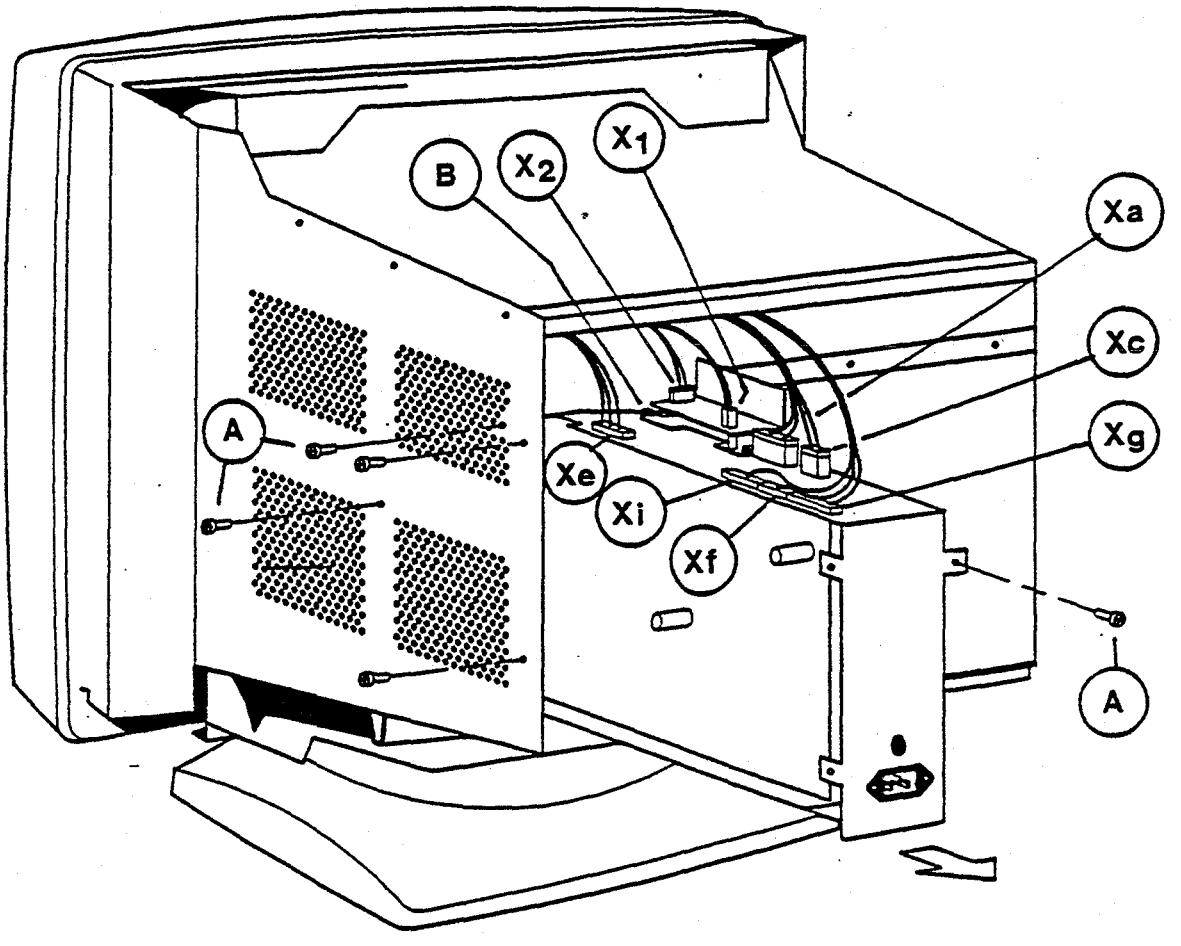


Figure A-7. Top Accessible Controls - C16-N & C20-N



1 - Red Gain
2 - Green Gain
3 - Blue Gain
4 - Horizontal Phase
5 - Horizontal Freq.
6 - EHT Stabilization
7 - Horizontal Centering
8 - Horizontal Linearity
9 - Vertical Hold
10 - E/W Pincushion
11 - Height
12 - Trapezium/Keystone
13 - Width
14 - Vertical Centering
15 - Serv.
16 - Vertical Linearity
17 - C. Lim

Figure A-8. Side and Back Controls - C16-N & C20-N



REPLACEMENT OF THE POWER SUPPLY

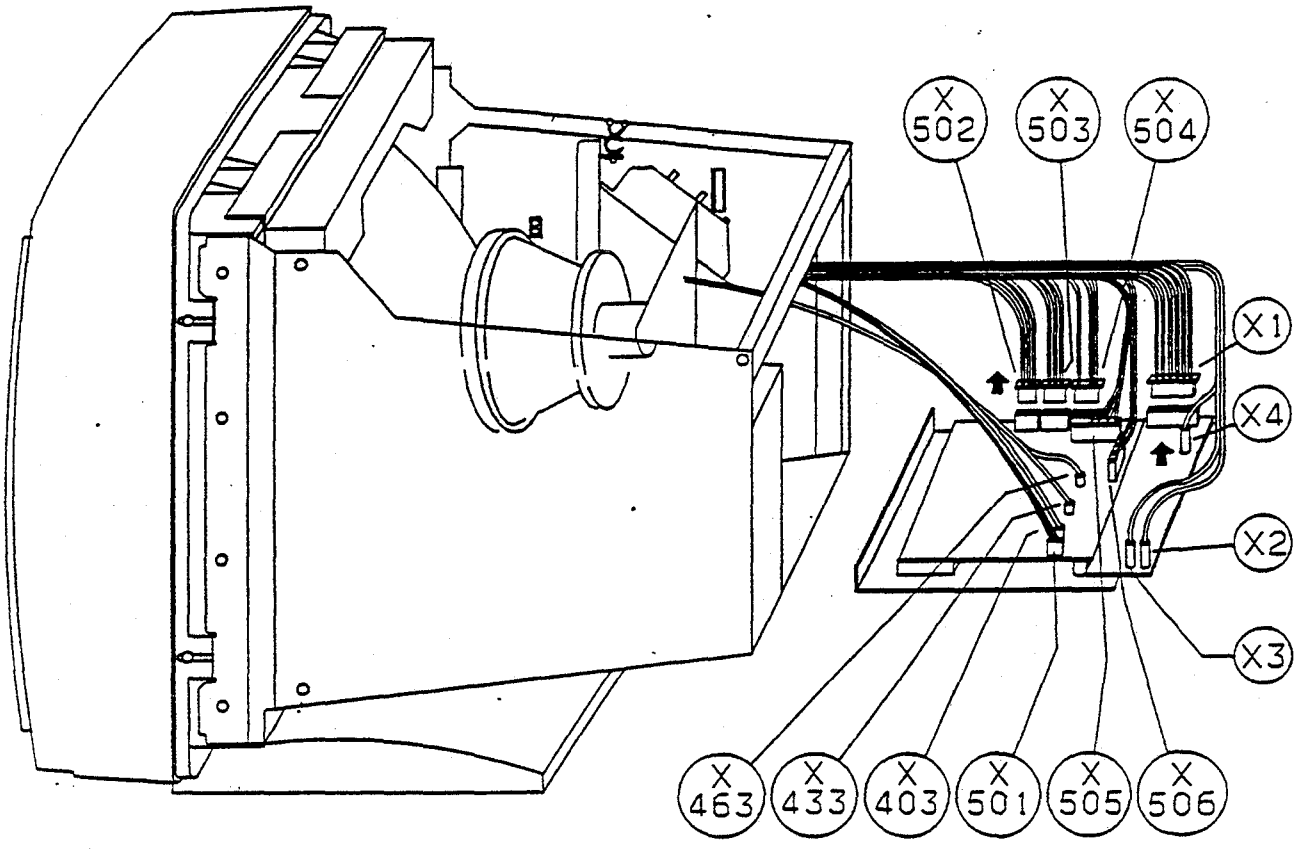
1-Remove the 5 screws (A) and the 2 screws (B)

2-Disconnect the plugs (Xa) (Xc) (Xe) (Xf) (Xg) (Xi) (X_1) (X_2)

3-Pull out the power supply unit.

To remount the power supply unit, reverse the previous procedure

Figure A-9. Replacing the Power Supply - C16-N & C20-N



REPLACEMENT OF THE VIDEO UNIT

1-Remove the screws (A) (see replacement of CRT socket).

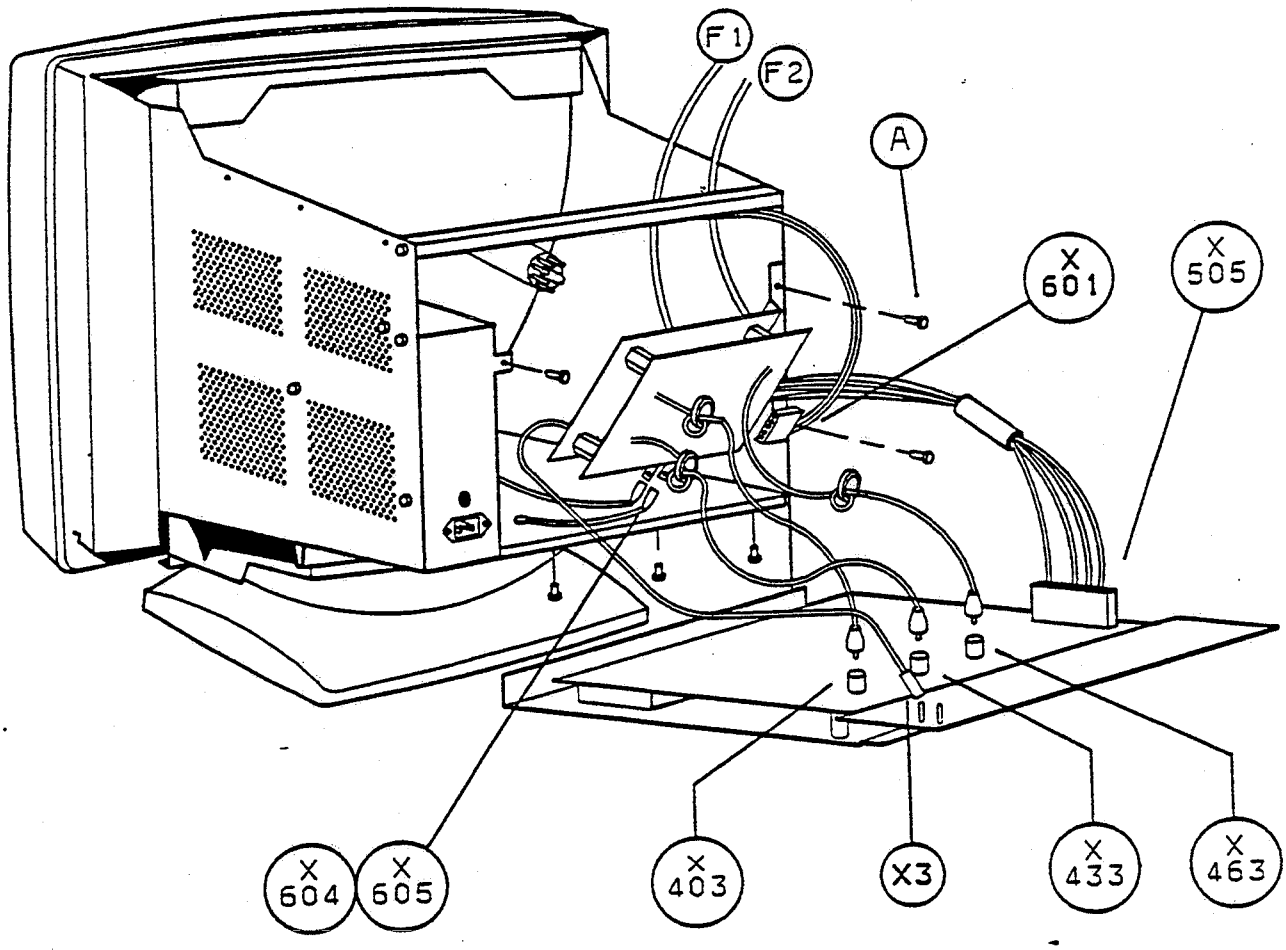
2-Disconnect the plugs turn down the video unit

X501 X502 X503 X504 X505 X506 X1 X2 X3 X4 X403 X433 X463

3-Remove the video unit.

To install the video unit, reverse the previous procedure.

Figure A-10. Replacing the Video Preamplifier Board - C16-N & C20-N



REPLACEMENT OF THE CRT SOCKET UNIT

1-Remove the screws (A)

2-Turn down the video unit.

3-Disconnect the plug (X 403) (X 433) (X 463) (X 505) (X 601) (X 604) (X 605) (X3)

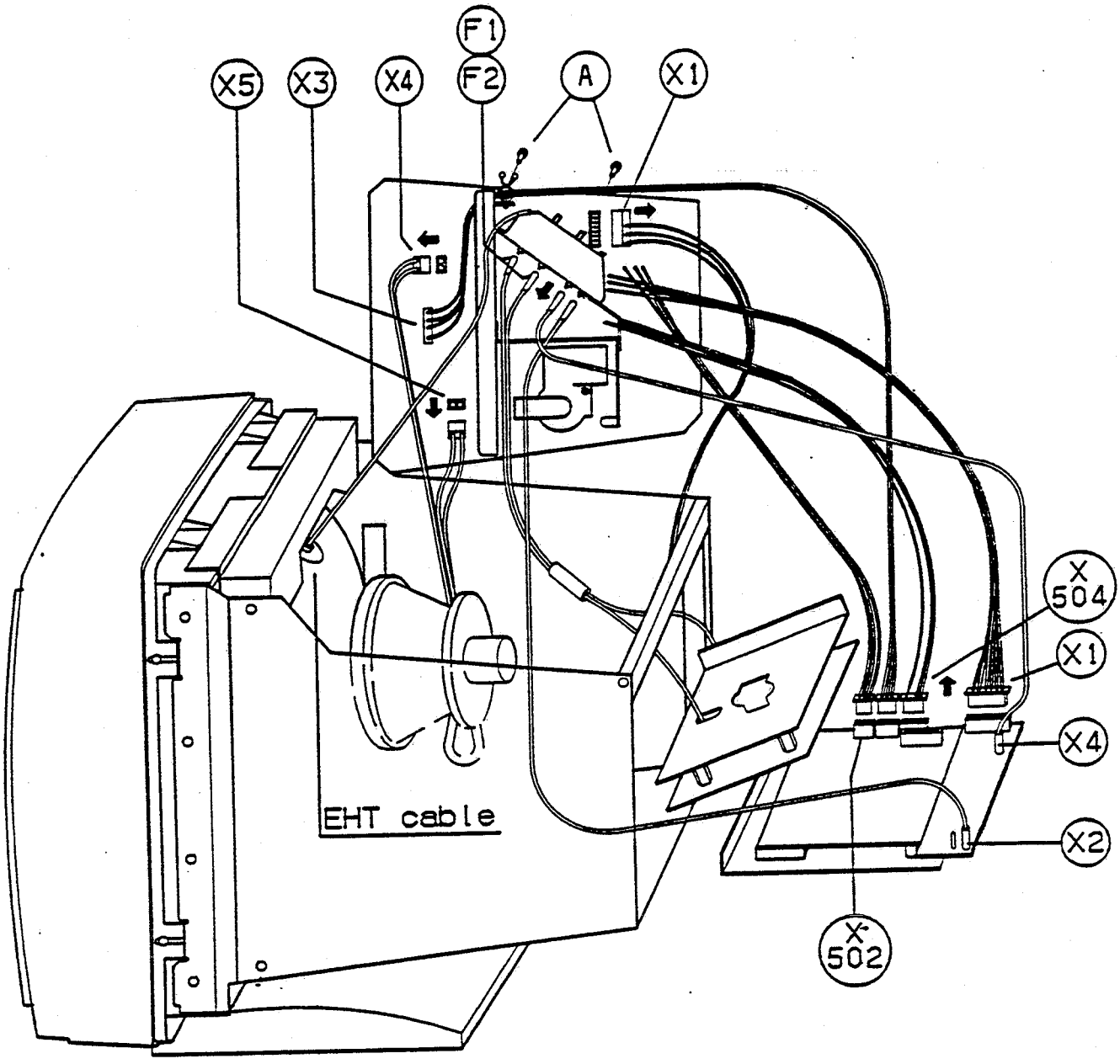
and the wires (F1) (F2) (see replacement of deflection unit)

4-Cut or remove the fixing compound between socket and CRT glass.

5-Pull back the complete CRT socket unit.

To remount the CRT socket unit, reverse the previous procedure.

Figure A-11. Replacing the CRT Socket Board - C16-N & C20-N



REPLACEMENT OF DEFLECTION UNIT

1-Remove the 2 screws (A)

2-Pull up the board.

3-Disconnect plugs (X1) (X2) (X3) no.2 (X4) (X5) (X 502) (X 504)

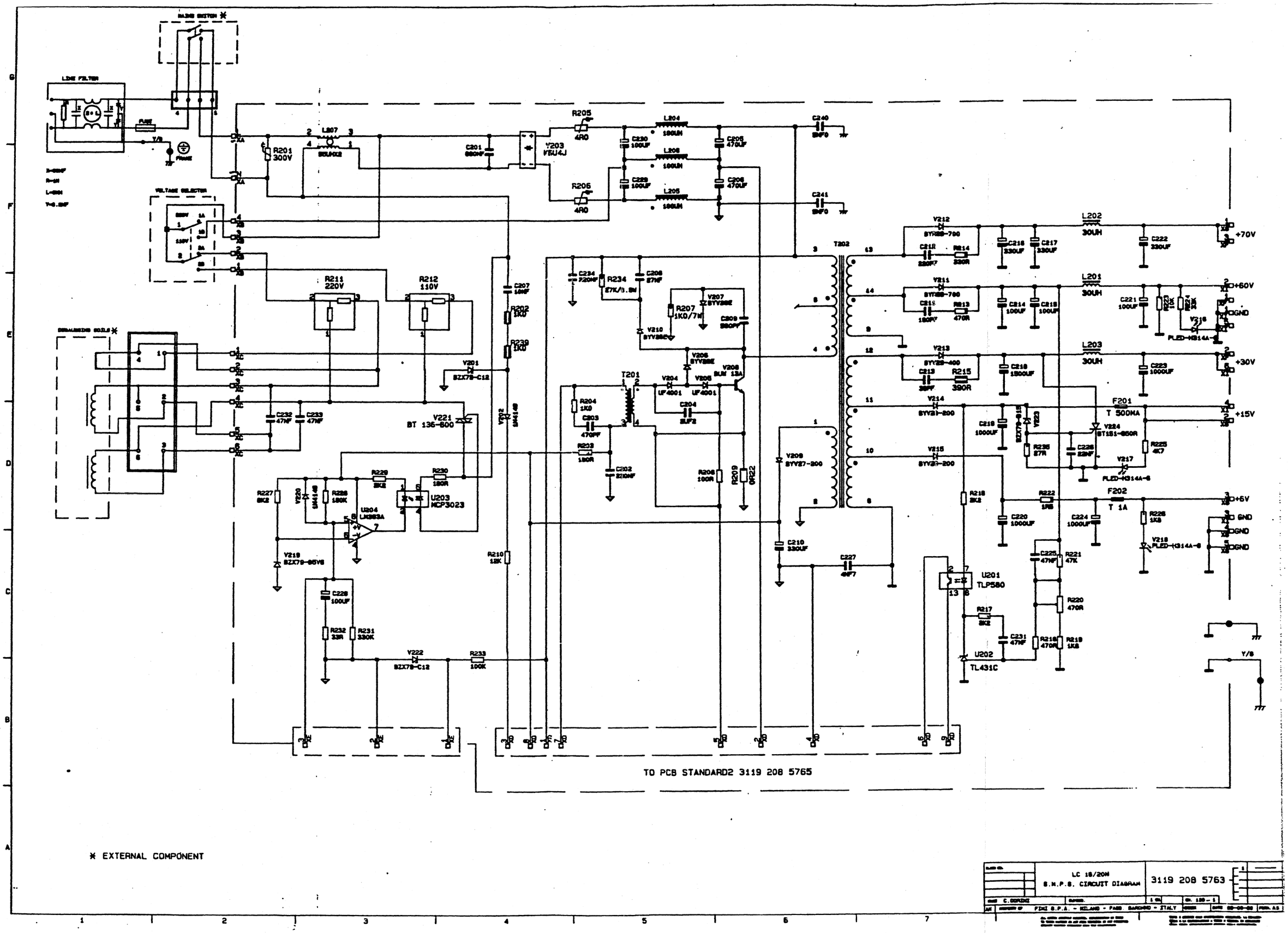
wires (F1) (F2) plus EHT cable.

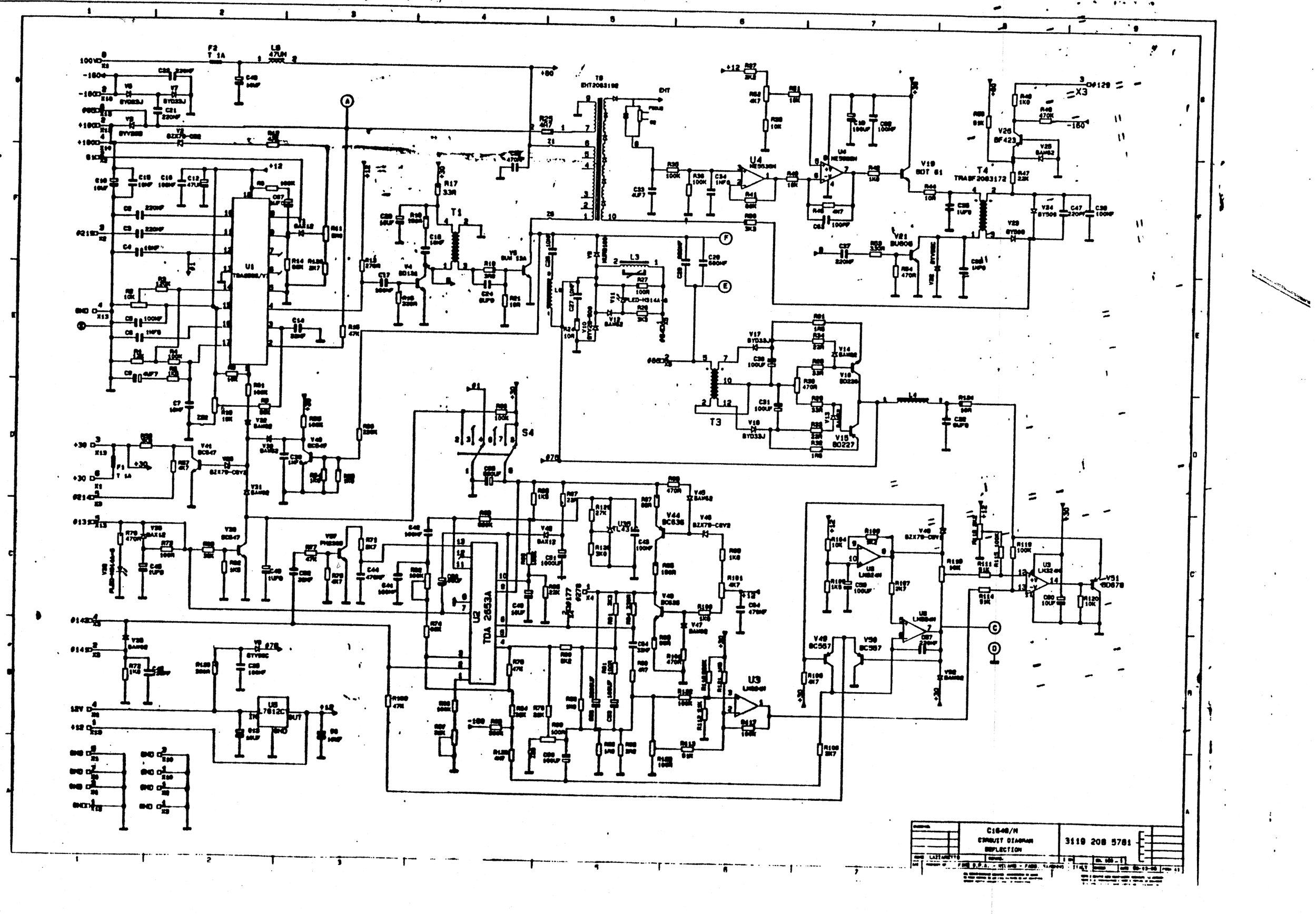
4-Remove the unit.

To install the deflection unit, revers the previous procedure.

Figure A-12. Replacing the Deflection Board - C16-N & C20-N

Appendix B


MAINS SWITCH *
LINE FILTER
FUSE
FRAME
VOLTAGE SELECTOR
DEGAUSSING COILS *
R201 300V
L207
BSU40X2
C201 680NF
Y203 Y5U4J
R205 4R0
R206 4R0
L204 100UH
L206 100UH
L205 100UH
C230 100UF
C229 100UF
C205 470UF
C206 470UF
C240 8NF0
C241 8NF0
T202
R211 220V
R212 110V
C207 10NF
R202 1K0
R239 1K0
V201 BZX79-C12
C232 47NF
C233 47NF
V221 BT 136-800
V212 BYW88-700
V211 BYW88-700
V213 BYV28-400
V214 BYV21-200
V215 BYV21-200
V209 BYV27-200
C234 220NF
R234 E7K/1.8W
C208 E7NF
R207 1K0/7W
V207 BYV28E
V210 BYV28E
C209 680PF
V206 BYV28E
V208 BUW 13A
T201
R204 1K0
C203 47NFF
R203 150R
C102 82NF
V204 UF4001
V205 UF4001
C204 8UF2
R208 100R
R209 0R22
C202 1NF
V202 1N4148
R210 12K
C210 330UF
C227 4NF7
C218 1000UF
C219 1000UF
C220 1000UF
C224 1000UF
C222 330UF
C216 330UF
C217 330UF
C214 100UF
C218 100UF
C223 1000UF
C221 100UF
R214 330R
R213 470R
R215 390R
C213 39PF
C212 680PF
C215 180PF
R212 33R
R211 33R
V216 PLED-HS14A-6
V217 PLED-HS14A-6
V218 PLED-HS14A-6
V223 BZX79-B15
R235 E7R
C226 22NF
R225 4K7
F201 T 500MA
V224 BT151-650R
F202 T 1A
R222 1R8
R226 1K8
C224 1000UF
R218 2K2
C220 1000UF
C225 47NF
R221 47K
R220 470R
R217 2K2
C231 47NF
R218 470R
R219 1K8
U201 TLP580
U202 TL431C
R220 2K2
R227 2K2
V220 1N4148
R228 180K
R229 2K2
R230 180R
U204 LM393A
U203 MCP3023
V219 BZX79-B5V6
C228 100UF
R232 33R
R231 330K
V222 BZX79-C12
R233 100K
+70V
+60V
GND
+30V
+15V
+6V
GND
DGND
DGND
Y/8
TO PCB STANDARD2 3119 208 5765
* EXTERNAL COMPONENT
LC 18/20M
S.M.P.S. CIRCUIT DIAGRAM
3119 208 5763
C.GORINI
FIMI S.P.A. - MILANO - PADR. BARANZATE - ITALY


C1640/N
CIRCUIT DIAGRAM
DEFLECTION
3119 208 5781
TDA 2653A
TRA BF2083172
BUT 61
BUB06
BF423
TL431
LM1881N
LM2404
LM324N
7812C
BZX79-C8V2
BZX79-C6V8
BAX12
BAW62
BC547
BC556
BC557
BD136
BD138
BY228
BY238
BY500
BY506
BY508
BYD33J
BYV28-600
BYV32EJ
BYV95C
LED-HS144-6
S4
T1
T3
T4
T8
U1
U2
U3
U4
U5
U6
U8
U9
U10
V25
V26
V31
X3
X4